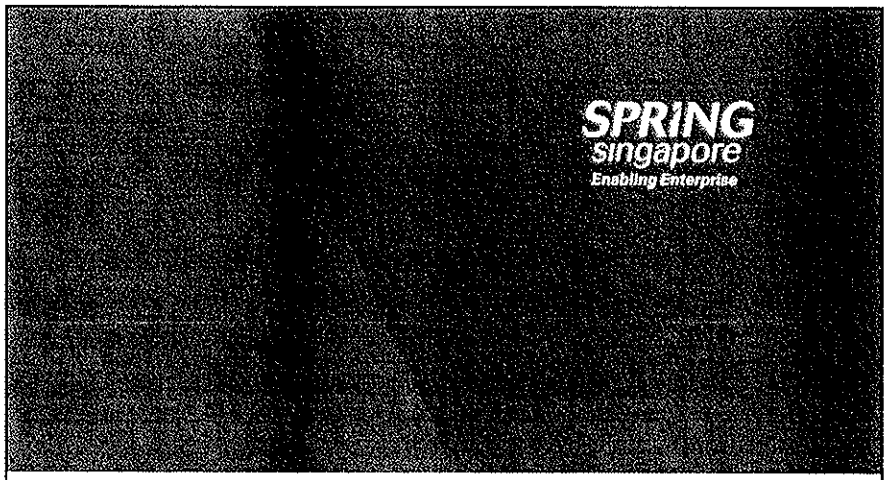

Overview in SS546:2009 (formerly CP-25) - Code of Practice for Emergency Voice Communication Systems in Buildings

Er. Kenneth Liu, Chairman of Technical Committee
for Emergency alarm and communication systems

26 August 2009

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Objectives of Revision

- CP 25 last published in 1999
- To keep abreast of the progress of emergency voice communication requirement in building
- To align with the Authority requirements of the new generation of high-rise buildings constructed in the recent years
- To align with new international reference code
- Review began in Jun'06 and draft was ready in Dec'08 for public comments
- 23 WG meetings held

Working Group For The Review of CP-25

Convenor : Mr David Goh

Members :

Mr Benedict Koh	*Mr Low Kim Seong*
Mr Benjamin Gan	*Cpt. Lau Heng Hui*
Mr Chan Gabin	*Mr Sng Chun Hui*
Ms Ivy Lee	*Mr Tay Cho Yiong*
Er. Kenneth Liu	*Mr Terence Tan*
Er. Loke Yee Weng	*Mr Thomas Ng*

Mr George Tan (served until Feb 08)

Review of CP:25 - Scope

- Covers planning, design, installation, maintenance and testing of emergency voice communication (EVC) systems in buildings
- Sets out technical and operational requirements for basic EVC system
- Recommended procedures for the use of the system and other information of an informative nature are given in the appendices

Review of CP:25 - Content

- Revised standard arranged in 3 Sections
  - Section 1: covers the Scope and General Requirements
  - Section 2: covers Design considerations such as control station, system designs and their operational requirements.
  - Section 3: covers Installation and maintenance.
  - Annexes A to D and Tables 1 and 2

Summary of Public Comments

- **Public comments from 9 Jan to 10 March 2009**
- **Received 40 comments**

Summary of Public Comments

Rephrasing and clarifications for :

- **EVC interfacing with fire alarm system - alarm sounding devices, time of operation and silencing requirements ,**
- **Requirements to cut off background music during emergency announcements and upon lifting of 2-way EVC handset,**
- **Requirements for EVC recording to start upon fire alarm activation or any other emergency signals and operate until manually reset,**
- **Cables within interconnecting EVC equipment in FCC need not to be fire-resistant,**

Summary of Public Comments

Rephrasing and clarifications for :

- **Requirements to have visual alarm or display signals for EVC in noisy rooms.**
- **Requirements that the wiring of the EVC system shall not be used for other services,**
- **2-way EVC handset enclosure and annual testing requirements,**
- **Requirements to have primary power supply and back up by emergency generator supply if available,**

Participating Organisations

- Association of Consulting Engineers Singapore (ACES)
- Fire Safety Managers' Association (Singapore) (FSMAS)
- Housing Development Board (HDB)
- Institute of Engineers, Singapore (IES)
- Land Transport Authority (LTA)
- Singapore Civil Defence Force (SCDF)
- Singapore Electrical Trade Association (SETA)
- Singapore Manufacturers' Federation (SMa)
- Industry experts in their individual capacity

Thank You

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Principal Changes in SS546:2009 (formerly CP-25)

Emergency Voice Communication Systems In Buildings

Mr. David Goh, WG Convenor & Deputy Chairman of Technical Committee for Emergency alarm and communication systems

26 August 2009

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SECTION ONE
SCOPE AND GENERAL REQUIREMENTS

- **1.1 Scope**
- **1.2 Definitions**
- **1.3 General requirements**
- 1.3.1 One-Way EVC system

  Emergency announcements, zones facilities, pre-recorded messages, priority of microphones, network of loudspeakers and line supervision.
- 1.3.2 Two-Way EVC system

  Two way emergency communication, network of remote handsets connected to master handset and line supervision.
- 1.3.3 Fire Command Centre

  Emergency communication centre, standby batteries and others essential display and control facilities.

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SECTION TWO
DESIGN CONSIDERATIONS

2.1 System components and equipment
2.2 Control station
2.3 Control station design and operational requirements
2.4 System design and operational requirements
2.5 Power supply

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SECTION THREE
INSTALLATION AND MAINTENANCE

3.1 Installation

3.2 Maintenance and testing

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KEY CHANGES - SECTION TWO

2.1 System components and equipment

2.1.1 General
EVC - Life Safety Systems to facilitate orderly emergency evacuation and co-ordinate fire fighting operations.

2.1.2 Compatibility
All components shall be compatible – different manufacturers.

2.1.3 Special environment
Performance in special environment- flammable or explosive.

2.1.4 Building management system
BMS shall not replace the EVC- only as monitoring

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KEY CHANGES - SECTION TWO

2.2 Control station

- Control console – Control station
- Other systems connected to EVC does not effect the EVC performance specified in this code.

a) One-way EVC
- Common or individual faults indicator(s) for amplifiers, microphones, loudspeaker circuits etc. c/w silencing switch.
- Switches to activate pre-recorded messages and isolate background music

b) Two-way EVC
Switches to activate remote handsets communication with indicators and audio fault silencing

c) Auxiliary functions
Switching facility to silence the alarm sounder after 15 seconds before initiating emergency announcements. It shall not affect other operation of the Fire Alarm System (FAS)

d) Indicators
Only LED and/or LCD, no filament lamps shall be use. Faults in Yellow, others in Red or Green

KEY CHANGES - SECTION TWO

2.3 Control station design and operational requirements

- All manual control shall be robust, avoid accidental operation, clearly labelled with sensory feedback.
- audio and visual testing facility

2.3.1 One-way EVC and 2.3.2 Two-way EVC

Background music shall cut-off during announcement and communication. It shall remain cut-off throughout the emergency situation.

2.3.3 Recording system

Remove tape recording – replace by recording systems

Shall start recording automatically upon receipt of fire alarm/emergency signals and activation of one-way / two-ways EVC systems.
Operate until manually reset. (2.3.3.3)

Periodic check to ensure full function at all times. (2.3.3.6)

KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.1 One-way EVC

2.4.1.1 General

Operate in conjunction with Fire Alarm System to control the safe evacuation by providing clear unambiguous voice instructions

2.4.1.2 Equipment and circuit design

Background noise exceed 90dBA, wearing ear protection-supplemented with visual alarm or display signals.

2.4.1.3 Messages

Message quality (2.4.1.3.1)
Every emergency message preceded by a non-speech attention-drawing signal - 500Hz to 1kHz

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KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.1.3 Messages

Language (2.4.1.3.2)
Repeat messages in different languages when English is not the first language. Choice of languages to be agreed with relevant parties.

Live voice messages (2.4.1.3.3)
Trained operators broadcast agreed standard messages from readily available script with pre-announcement tone. Minimum of 2 cycles (alert and evacuation)

Pre- recorded messages (2.4.1.3.4)
Recording by trained persons with proper use of microphone in studio.
Alert messages- min. 2 cycles and continue until manually silenced or superseded by evacuate/2nd alert message.
Evacuation messages- min. 2 cycles and continue until manually silenced.

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KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.1.4 Fault monitoring

Loudspeaker circuits shall be protected against accidental or fire damage, one speaker zone fault shall not affect other zone, short circuit shall not cause associated amplifier damage.

An audio and individual visual fault indication within 100sec

a) open/short/earth faults – loudspeaker and spur circuit
b) failure of microphone and wiring up to the capsule
c) operation of circuit breaker, isolator/protective devices, fuse blown within the critical signal paths preventing emergency broadcast
d) failure of transmission paths between components of a distributed system

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KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.1.5 Power amplifiers

Standby amplifier(s) shall be provided

a) automatically replace failed amplifier with same rating
b) automatically disconnect failed amplifier with paralleled amplifier to meet the load requirement
c) all amplifiers in power up state and monitor
d) an alternative a) & b)- use more amplifiers for large loudspeaker circuits but designed must ensure failure of an amplifier does not result in failure of intelligibility
e) amplifier's rated power- min. 20% greater than initial design load
f) to achieve acceptable intelligibility – the -3dB frequency response of the amplifier should be at least 200Hz to 8kHz

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KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.1.6 Loudspeaker zones

a) grouped and control by zone, floor area & escape staircases, selectively and collectively at FCC
b) shall not conflict with the boundaries of fire detection zones. Fire detection zone should not contain more then one emergency loudspeaker zone
c) the boundaries should be fire- resisting construction
d) to aid acoustic - the boundaries should coincide with walls, permanent partitions or door
e) if include more then one detection zone, boundaries of loudspeaker zones should be boundaries of relevant detection zones
f) Designer's responsibility- configuration of loudspeaker zones and the cause and effects controlling emergency messages
g) besides 'emergency all call' function – single selection for pre-determined collective groups of zones

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KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.1.7 Interface with the fire alarm system

- EVC and FAS should link to maintain the integrity of overall operation
- Linking facilities fail or remove - alarm messages continue to broadcast
- Systems with distributed control equipment- multiple linking rather than a central location

To maintain linking facility integrity:-

a) faults indication at alarm panel for open/short circuit of the link(s) between EVC and FAS
b) link(s) should be protected against fire/mechanical damage and pass through low fire risk area
c) linking facilities should not fail with single fault on linking wire, if wire is more then 10 m
d) EVC and FAS linking via fire detection circuit, removal of any detector(s) / single circuit fault should not affect communication to EVC
e) multiple linking-no conflicting commands to EVC system

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KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.2 Two-way EVC

2.4.2.1 General

Independent of all other communication systems, consist of master handset, selector switches at FCC and remote handset at designated locations
All handset shall be Red

2.4.1.2 Remote handset

located on each storey, basements, in fire fighting lobby or area approved by the Authority and the following:

a) fire fighting equipment rooms (ex. sprinkler pump room etc)
b) smoke control equipment rooms
c) lift machine rooms
d) fire lift- exempted if lift intercom complies with power supply (2.5) and installation (3.1)
e) each area of refuge
f) air-handling control rooms

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KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.2.3 Remote handset enclosure

lockable and easily accessed front door, mounted 1.5m above the floor to the centre, outdoor-IP65

'EMERGENCY'- in Red or white on red background & 20mm height

2.4.2.4 Operational requirements

- two-way EVC - party-line and private-line (2.4.2.4.1)
- party-line- control station can break in or terminate communication to all handsets (2.4.2.4.2)
- communication between or among remote handsets w/o master handset is not allow (2.4.2.4.3)

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KEY CHANGES - SECTION TWO

2.4 Systems design and operational requirements

2.4.2.4.4 call from remote handsets to master handset

a) control station audio signals-continuous or pulsing
b) reassurance tone at remote handset before communication
c) under private-line- 2nd remote handset call receive busy tone only joint in after zone switch activated at control station or party-line mode activated one remote handset off hook shall not jeopardize others
d) shut down background music - manually restart

2.4.2.4.5 call from master handset to remote handsets

a) facilities for control station to call any remote handsets shall be provided
b) audible signal received at remote handset, raising handset automatically enable communication
c) if excessive background noise, provide visual signal

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KEY CHANGES - SECTION TWO

2.5 Power supply

2.5.1 Form of supply

- primary supply from DB with isolator, terminated inside EVC panel, no intermediary switch allowed and exclusive for EVC systems- backed up by generator when provided
- secondary supply from batteries with charger
- fault warning provided for primary/secondary supply failure

2.5.2 Battery charger

- appropriate type and rating with max. operating load
- recharged to min. 80% capacity within 24 hours and full capacity within another 48 hours

2.5.3 Battery capacity

- not less then 4 hours-with generator set, 2 hours

2.5.4 Battery location

- cool, dry & well-ventilated location. Cabinet accessible for inspection and not above the control station - prevent corrosion

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KEY CHANGES - SECTION THREE

3.1 Installation

3.1.1 General

- installation – separate and distinct from other systems. wiring comply to CP5 and this code
- independent wiring to each zone/location, dual redundancy circuit for multiplexing and addressable systems
- needs to operate over a reasonable range of ambient conditions-temperature and humidity

3.1.2 Cables and wiring

- electrical characteristics-voltage, current capacity and impedance (3.1.2.1)
- conductor sizing-physical strength, limitations imposed by voltage drop/signal attenuation (3.1.2.2)
- EVC wiring shall not be use for other services (3.1.2.4)

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KEY CHANGES - SECTION THREE

3.1 Installation

3.1.2.3 Protection – Fire / Mechanical damage

- fire resistant cable comply with SS299
- interconnecting cables for EVC equipment-need not be fire resistant in FCC
- subject to mechanical damage - additional protection
- penetrations- avoid free passage of fire or smoke

3.1.2.5 Transmission signals and environmental conditions

- electric noise disturbing audio signal / corrupting transmitted data
- incorrect choice of cable for speed of data transmission or impedance matching
- voltage drop limiting power transmission
- vibration, ambient temperature of humidity
- hazardous areas / specific safety requirements
- max. 10% voltage drop in any loudspeaker circuit (1 dB loss of sound pressure level)

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KEY CHANGES - SECTION THREE

3.2 Maintenance and testing

3.2.1 General

- owner to establish service agreement with manufacturer or competent contractor
- owner representative with suitable experience and training

3.2.2 Regular testing and inspection

- owner's responsibility to ensure regular testing conducted with proper log record

3.2.3 Recommended service plan for one and two way EVC

3.2.3.1 Inspection- intervals not exceeding three months:-

- no obstruction, no fire hazards near to the EVC equipment
- indications remain readily visible and operating instructions are available

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KEY CHANGES - SECTION THREE

3.2 Maintenance and testing

3.2.3.2 Testing of one-way EVC system - intervals not exceeding three months:-

a) measure emergency broadcasting time required by operator or from fire alarm signal
b) during emergency operation, disabled all non-emergency functions
c) able to broadcast in one or more areas simultaneously
d) speech intelligibility and sound pressure level are satisfied
e) operator able to receive indications of the correct functioning
f) check standby battery power source
g) communication link between FAS and EVC
h) messages transmitted over all loudspeakers using microphone in FCC
i) actuating all loudspeakers selectively and collectively from FCC
j) all auxiliary functions

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KEY CHANGES - SECTION THREE

3.2 Maintenance and testing

3.2.3.3 Testing of two-way EVC system - intervals not exceeding three months:-

a) visual inspection-all remote handsets unobstructed and conspicuous
b) call from remote handset is correctly received
c) different remote handset should be tested in rotation – all remote handsets tested min. once a year and recorded
d) check all audio/visual indications at FCC
e) transmitting calls between remote-handset and master-handset under party-line and private-line mode
f) check standby battery power source
g) check fault indications by faults simulation
h) all auxiliary functions
i) further checks recommended by manufacturer
j) record all defects and rectified

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KEY CHANGES - SECTION THREE

3.2 Maintenance and testing

3.2.4 Log

Purpose:

- allow investigation when system failed to broadcast
- monitor pattern of failure- aiding the diagnosis and preventive maintenance

Include:

- dates and times of usages / faults occurrence
- details of tests / routine checks / faults found and action taken to rectify

3.2.5 Special inspection with new service organization

- existing record – available and studied for future servicing of the EVC systems

3.2.6 Modification to the system

- arise from systems extension or newly construction unprotected area – ensure systems continues to comply

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Guidance for the Design and Modification Work of Emergency Voice Communication (EVC) Systems

Cpt Lau Heng Hui, Member of Technical Committee for CP 25 & Fire Safety Consultant, SCDF

26 August 2009

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SCOPE OF PRESENTATION

ANNEX A

A.1 One-way EVC system

A.2 Two-way EVC system

ANNEX D

Recommendations applicable to all modification work

2

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ANNEX A
Guidance for the design of EVC systems.

A.1.1 General Information

A.1.2 Intelligibility of speech messages
- Audibility
- Clarity

A.1.3 Measurement of intelligibility

A.1.4 Typical ambient noise levels and their effect on system design

A.1.5 Priorities

3

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ANNEX A.1
One-Way EVC systems

A.1.1 General Information





- Based on agreed building evacuation plan and procedures
- Consultation between owner and system designer
- Priority of messages/alarms based on different types of hazards including fire
- Higher priority alarm cannot be prevented or masked by one of lower priority

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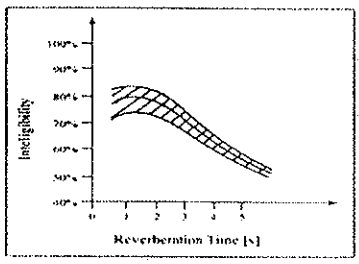
ANNEX A.1
One-Way EVC systems

A.1.2 Intelligibility of speech messages



Ratio of direct to reverberant sound is the critical factor for intelligibility.

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ANNEX A.1
One-Way EVC systems

- Use of highly controlled dispersion pattern loudspeakers
- Correct choice and quantity of loudspeakers in the right locations
- Dynamic level control upon ambient noise sensing
- Establishing the likely level of ambient, background, or occupational noise



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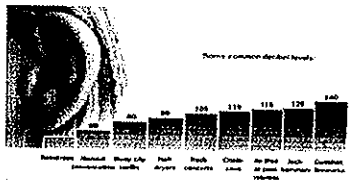
ANNEX A.1
One-Way EVC systems



A.1.2.1 Audibility

- Speech signal to background noise level ratio should be at least 10 dB
- If the background, occupational or ambient noise is greater than 75 dBA, a qualified electroacoustic designer should be considered

A.1.2.2 Clarity

- a qualified electroacoustic designer should be considered if
  - the reverberation time is greater than 1.5 s
  - If the listener to loudspeaker distance is greater than 10 m,

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ANNEX A.1
One-Way EVC systems

A.1.2 Measurement of intelligibility



- Objective or Subjective ?
- If Objective
  - A minimum Speech Transmission Index (STI) of 0.5
  - May be lower than 0.5 for special cases
    - High background noise
    - Understood by people who are familiar with them
  - Can be assessed under worst expected noise level conditions
- If subjective
  - Based on both intelligibility and audibility
  - Messages or text read into a system microphone, preferably unknown to users

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ANNEX A.1
One-Way EVC systems

A.1.4 Typical ambient noise levels and their effect on system design

- A minimal signal to noise ratio of 10dB and above
- Increase of 3dB require doubling of amplifier power and possibly more loudspeakers
- Most realistic ambient noise level as design datum

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ANNEX A.1
One-Way EVC systems

Area/room	Likely a... noi... dB	Usage ... Increa... dB	Design SPL		Design frequency response
cultural centre					
Lounge	70	4	84	80%	125 Hz – 12 kHz ± 3 dB
Toilets	60	9	79	80%	300 Hz – 6 kHz - 3 dB
entrance lobby and lounge	73	6	89	90%	300 Hz – 6 kHz ±3 dB
Bar Lounge	65	9	84		300 Hz – 6 kHz +3 dB
Specialty restaurant	65	9	84	80%	300 Hz – 6 kHz ± 3 dB
conference room	70	6	86	95%	125 Hz – 12 kHz ± 3 dB
meeting room	70	6	86	95%	125 Hz – 12 kHz ± 3 dB
health club – internal	68	6	84	80%	300 Hz – 6 kHz ± 3 dB
health club – aerobics	75	12	97	80%	300 Hz – 6 kHz ± 3 dB

An example of design criteria for public spaces in a hotel.

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ANNEX A.1
One-Way EVC systems

Area/room	Likely ambient noise dBA	Usage noise increase dB	Design SPL dBA	Design coverage	Design frequency response
cultural centre	70	3	83	80%	300 Hz – 6 kHz ± 3 dB
Lounge	70	4	84	80%	125 Hz – 12 kHz ± 3 dB
Toilets	60	9	79	80%	300 Hz – 6 kHz +3 dB
entrance lobby and lounge	73	6	89	90%	300 Hz – 6 kHz ±3 dB
bar lounge	65	9	84	80%	300 Hz – 6 kHz ±3 dB
Speciality restaurant	65	9	84	80%	300 Hz – 6 kHz ±3 dB
conference room	70	6	86	95%	125 Hz – 12 kHz ± 3 dB
meeting room	70	6	86	95%	125 Hz – 12 kHz ± 3 dB
health club – internal	68	6	84	80%	300 Hz – 6 kHz ±3 dB
health club – aerobics	75	12	92	80%	300 Hz – 6 kHz ±3 dB

An example of design criteria for public spaces in a hotel.

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An example of typical real life noise levels

Typical level dB	Location	Comments
50	general office	financial institution
58	suburban train carriage	slow speed, quiescent
62	mainline station platform	no trains
65	restaurant/canteen	financial institution
67	call centre office	financial institution
72	station café (reverberant with ceramic floor)	quiescent, not many customers, background music, espresso coffee machine
95[A]	football match crowd noise	30 000+ seater stadium
97[A]	vehicular traffic in a motorway tunnel)	
98[A]	pop concert (outdoors)	at the mixer riser
100[A]	pop concert (indoors)	at the mixer riser

[A] Measured as $L_{A10,t}$

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An example of typical real life noise levels

Typical level (L_{Aeq}) dBA	Location	Comments
50	general office	financial institution
62	mainline station platform	no trains
67	call centre office	financial institution
69	in a carriage of a train	high speed (approx 160 km/h)
70	saloon bar of pub	typical weekday crowd
72	station café (reverberant with ceramic floor)	quiescent, not many customers, background music, espresso coffee machine
75	mainline station platform	during an announcement (unintelligible)
85	mainline station platform	train passing through slowly
95[A]	football match crowd noise	30 000+ seater stadium
97[A]	vehicular traffic in a motorway tunnel	
98[A]	pop concert (outdoors)	at the mixer riser
100[A]	pop concert (indoors)	at the mixer riser

[A] Measured as L_{AIeq}

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An example of typical real life noise levels

Typical level (L_{Aeq}) dBA	Location	Comments
45	domestic kitchen	quiet, no activity
50	rural garden	good breeze in trees, birdsong
50	general office	financial institution
58	suburban train carriage	slow speed, quiescent
62	mainline station platform	no trains
65	restaurant/canteen	financial institution
67	call centre office	financial institution
69	in a carriage of a train	high speed (approx 160 km/h)
70	saloon bar of pub	typical weekday crowd
72	station café (reverberant with ceramic floor)	quiescent, not many customers, background music, espresso coffee machine
73	station café (reverberant with ceramic floor)	as above but during an announcement (unintelligible)
75	mainline station platform	during an announcement (unintelligible)
85	mainline station platform	train passing through slowly
95[A]	football match crowd noise	30 000+ seater stadium
97[A]	vehicular traffic in a motorway tunnel	
98[A]	pop concert (outdoors)	at the mixer riser
100[A]	pop concert (indoors)	at the mixer riser

[A] Measured as L_{AIeq}

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ANNEX A.1
One-Way EVC systems

A.1.5 Priorities

A.1.5.1 Priority level in descending order, should be:

1. emergency microphone (s)
2. pre-recorded evacuate message regarding potentially life threatening situation needing immediate evacuation
3. pre-recorded alert message regarding dangerous situation nearby requiring warning of potential evacuation
4. other emergency pre-recorded messages
5. non-emergency messages

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ANNEX A.2
Two-Way EVC systems

A.2.2 Intended use for two-way EVC systems

A.2.2.1 By building management
» Between FSM and fire wardens prior to arrival of Fire Services

A.2.2.2 By Fire Services during evacuation

A.2.2.3 By Fire Services after evacuation

A.2.2.4 By disabled people

A.2.2.4 Other uses
» Loudspeaker capability

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ANNEX D
Recommendations applicable to all modification work

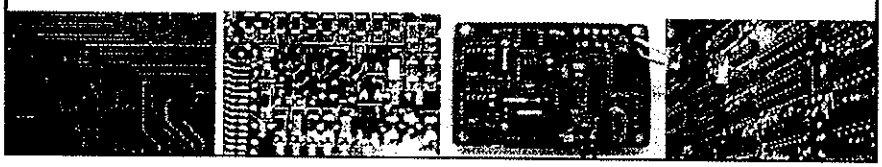
a) All components, circuits, system operations and site-specific software functions affected by the modification should be tested

b) If one or more devices have been added to or removed from a circuit, at least one other device on the same circuit should be tested.

c) If the control equipment has been modified, at least one device on every circuit should be tested.

d) If any additional load has been placed on the system, the rating of the power supply unit and the capacity of the standby battery shall still remain adequate.

e) If software has been modified, further random testing of other parts of the system should be carried out to ensure that seemingly unrelated parts of the system have not been adversely affected.



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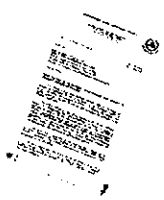
Conclusion

- Annex A and D gives guidance on the development of EVC systems
- The date of implementation is 1st January, 2010
- SCDF Circular



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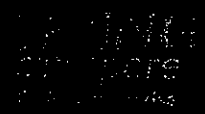
Thank You



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Practical Application and Implementation Benefits of SS 546 : 2009 – A Electrical Contractor's Perspective

Low Kim Seong, Member of Singapore Electrical Trades Association and Member of TC for Emergency Alarm and Communication Systems

26 August 2009

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Topics

- Implementation Benefits of SS 546 : 2009
- Systems Configuration
- Loudspeakers Distribution
- Clarity and Intelligibility of Speech
- Interface to Fire Alarm System
- Systems Operations and Maintenance

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Implementation Benefits of SS 546 : 2009

- Good Engineering Practice
  - Easy Integration to Building Construction Programs
  - Clearer Guidelines to Systems Implementation
- Systems Reliability
  - Highly Reliable due to Constant Faults Monitoring
  - Shorter Remedy Process
- Increase Competency
  - Experiences
  - Clients' Confidence

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Systems Configuration

- Systems requirement
- Block diagrams and examples
- Do & Don't

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Systems Requirement

1-way EVC System :

- **Microphone with zones controls**
- **Signal processor with pre-amplifier and mixer**
- **Fault monitoring with indications**
- **Event recording device**
- **Interface to Fire Alarm System**
- **Back-up power supply with batteries**
- **Speaker zones distribution**
- **Power amplifiers with standby amplifiers**
- **Override facilities**
- **Loudspeakers**

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Systems Requirement

2-way EVC System :

- **Master handset**
- **Signal processor with remote selectors**
- **Fault monitoring with indications**
- **Event recording device**
- **Interface to Fire Alarm System**
- **Back-up power supply with batteries**
- **Remote handsets distribution**
- **Remote handsets**

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Systems Requirement

Fire Command Centre (FCC) :

- **As a communication centre for the building Fire Safety Manager or Fire Fighting Personnel**
- **Equipped with controls and display of the status of EVC and Alarm Systems**
- **Sound resistance construction with sound attenuation of not less than 50dB**
- **Fire protected room**

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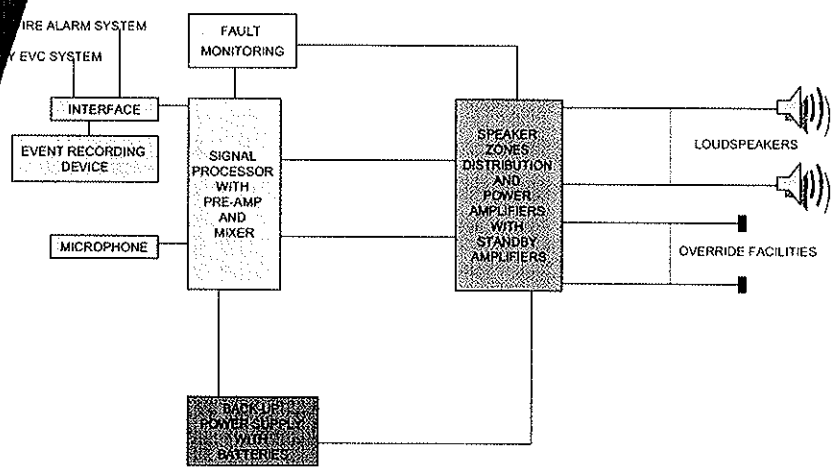
Typical configuration of 1-way EVC System



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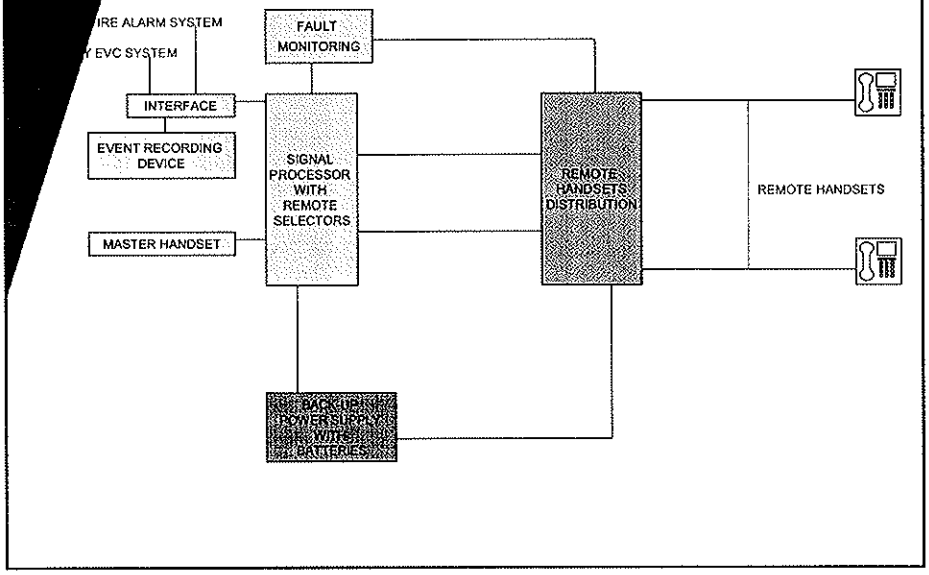
Typical configuration of 2-way EVC System



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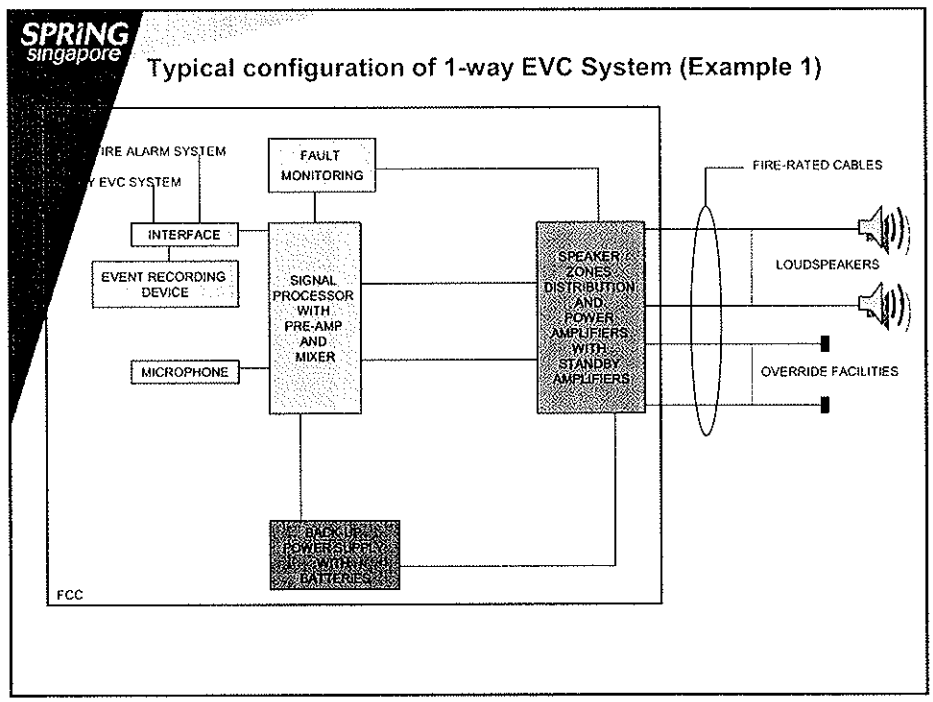
Typical configuration of 1-way EVC System (Example 1)



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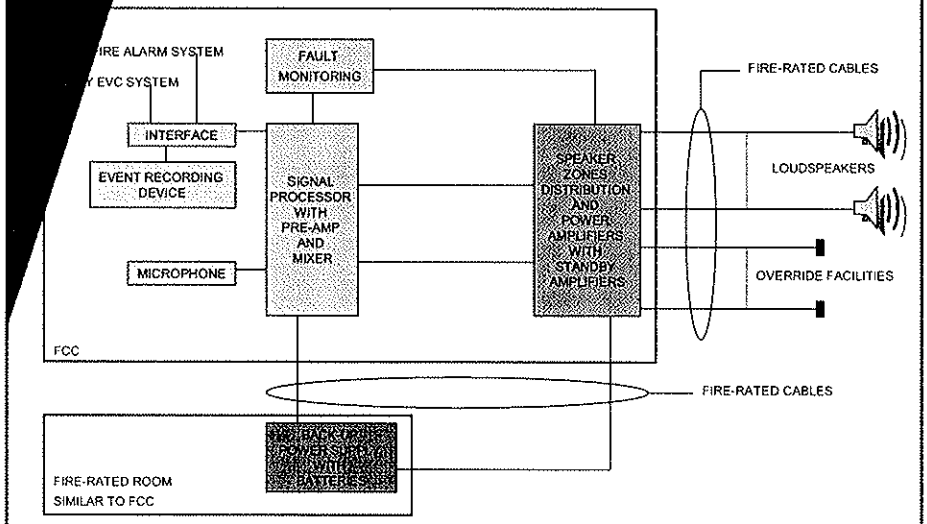
Typical configuration of 1-way EVC System (Example 2)



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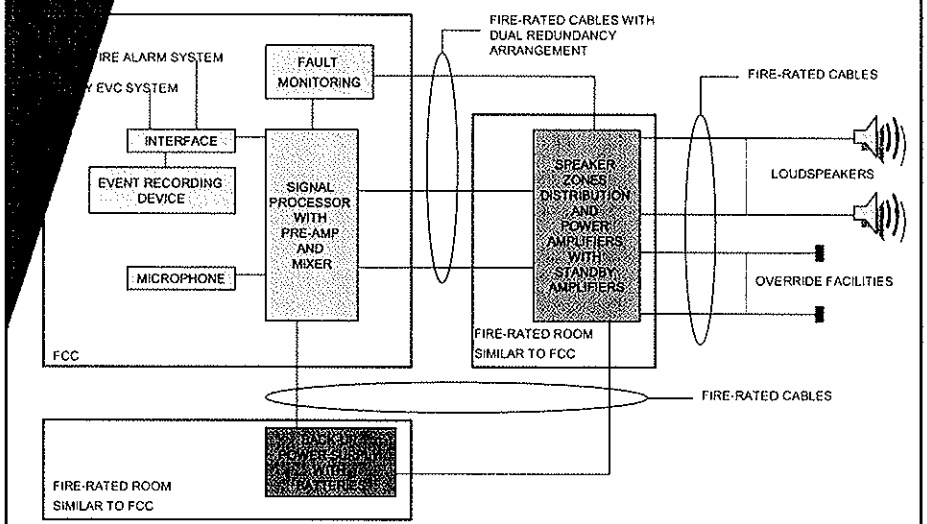
Typical configuration of 1-way EVC System (Example 3)



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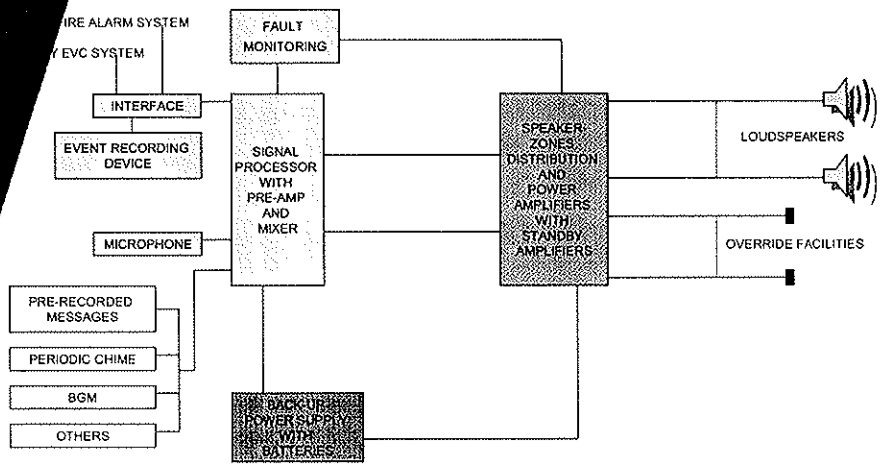
Typical configuration of 1-way EVC System with other systems



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Do & Don't

- Do
  - Use Fire-rated cables
  - Rooms to house the EVC equipment other than FCC to be fire protected with same fire-rating
  - Dual redundancy arrangement for equipment outside FCC

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Loudspeakers Distribution

- Loudspeakers coverage
  - ➢ **Loudspeakers selection**
    - ➢ **Output power**
    - ➢ **Dispersion angle**
    - ➢ **Frequency response**
  - ➢ **Acoustic environment**
    - ➢ **Construction**
    - ➢ **Building materials**
    - ➢ **Estimated ambient noise level**
  - ➢ **Loudspeakers location**
    - ➢ **Mounting level**
    - ➢ **Area to be served**
    - ➢ **Sound pressure level (SPL) calculations**

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Sound Pressure Level (SPL) Calculations

$$\text{SPL Attenuation (dB)} = 20 \times \text{Log}_{10} \frac{\text{Distance 2}}{\text{Distance 1}}$$

SPL at single point (dB) = Output SPL/w/m - SPL Attenuation

$$\text{SPL Addition: Total SPL(dB)} = \text{Log}_{10} \left(10^{\frac{L1}{10}} + 10^{\frac{L2}{10}} + \cdots + 10^{\frac{Ln}{10}} \right)$$

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Table 1: Both Circuits A & B in operation (Layout)

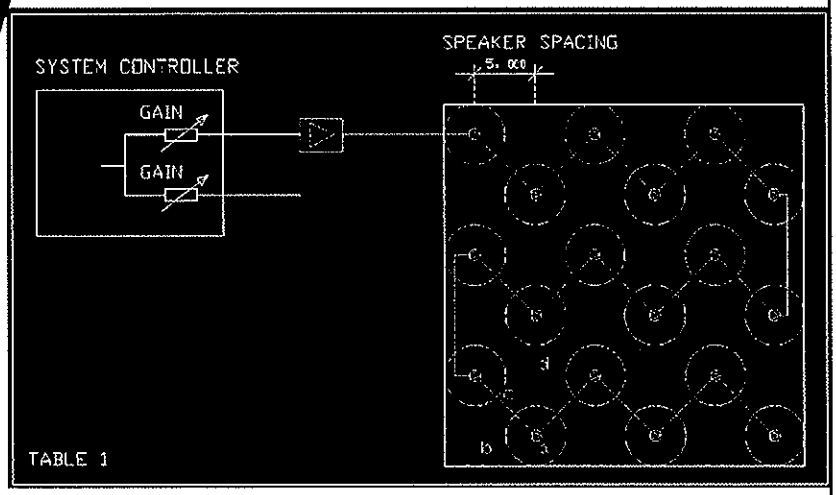

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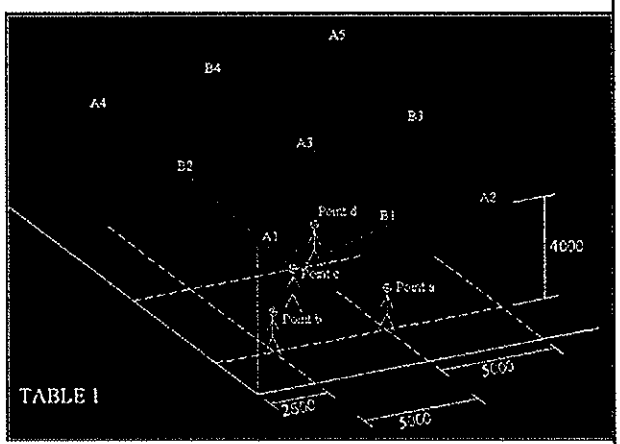
Table 1: Both Circuits A & B in operation (Layout)



Loudspeakers Spacing : 5m
Ceiling Height : 4m
Average Human Ears Level : 1.5m
Ambient Noise : 70dB

Point of listener	Effective Distance From Loudspeaker (mm)									Effective SPL (dB) at 90dB/w/m
	A1	B1	A2	B2	A3	B3	A4	B4	A5	
point a		2,500.00								82.04
point b	2,500.00									82.04
point c	4,330.00	4,330.00		4,330.00	4,330.00					83.29
point d					2,500.00					82.04
									Overall SPL Difference:	1.25

Table 2A: Circuit A failed, Circuit B in operation (Layout)

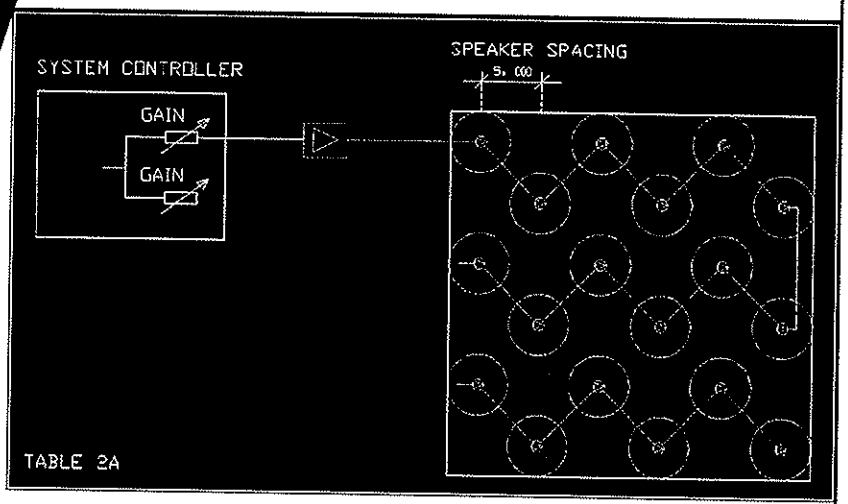


Table 2B: Circuit A failed, Circuit B in operation with output SPL increase 3dB (Layout)

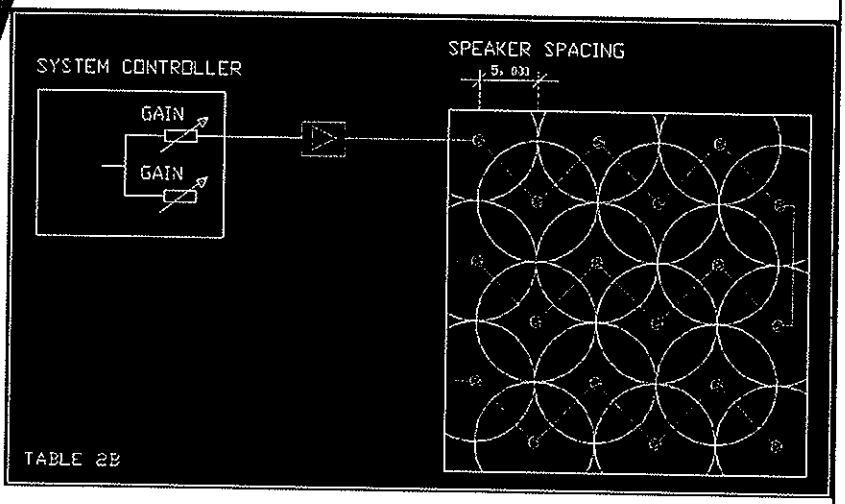
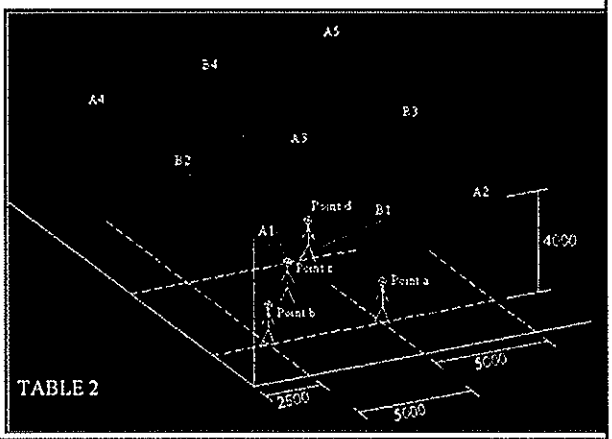


Table 2: Circuit A failed, Circuit B operating with output SPL increase 3dB (Effective SPL)



Loudspeakers Spacing : 5m
Ceiling Height : 4m
Average Human Ears Level : 1.5m
Ambient Noise : 70dB

Point of listener	Effective Distance From Loudspeaker (mm)									Effective SPL (dB) at 93dB/w/m
	A1	B1	A2	B2	A3	B3	A4	B4	A5	
point a		2,500.00								85.05
point b		5,590.00		5,590.00						81.07
point c		4,330.00		4,330.00		8,292.00		8,292.00		84.33
point d		5,590.00		5,590.00		5,590.00		5,590.00		84.08
									Overall SPL Difference:	3.98

Table 3: Circuit B failed, Circuit A in operation (Layout)

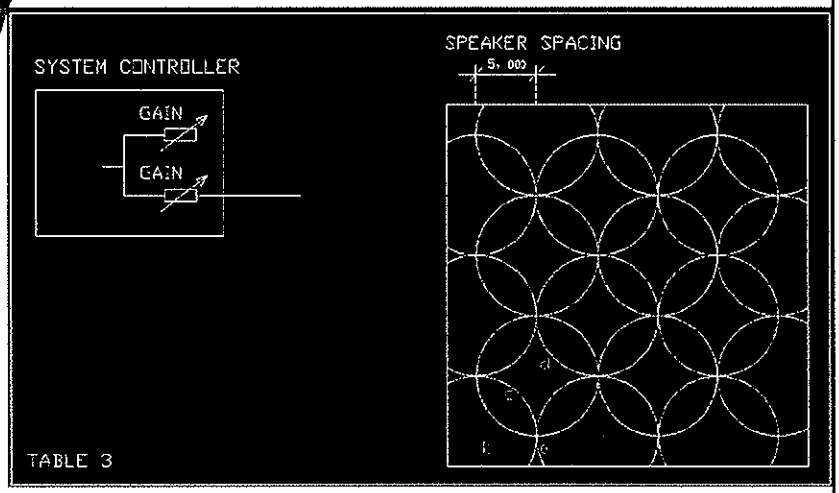


Table 3: Circuit B failed, Circuit A operating with output SPL increase 3 dB (Effective SPL)

Loudspeakers Spacing : 5m
Ceiling Height : 4m
Average Human Ears Level : 1.5m
Ambient Noise : 70dB

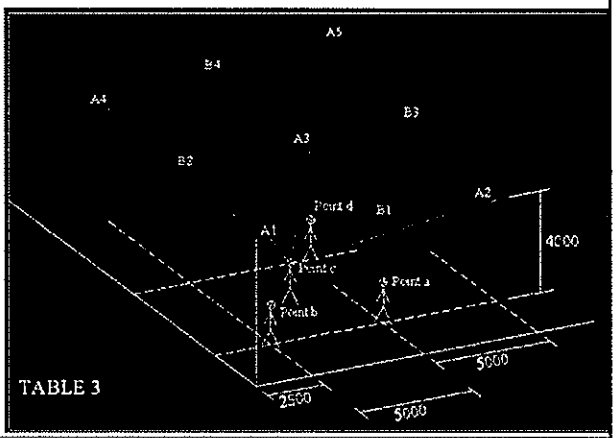


TABLE 3

Point of	Effective Distance From Loudspeaker (mm)									Effective SPL (dB)
listener	A1	B1	A2	B2	A3	B3	A4	B4	A5	at 93dB/w/m
point a	5,590.00		5,590.00		5,590.00					82.83
point b	2,500.00									85.05
point c	4,330.00		8,292.00		4,330.00		8,292.00			84.33
point d					2,500.00					85.05
									Overall SPL Difference:	2.22

Clarity and Intelligibility of Speech

- Quality of audible speech may be affected by the following conditions :
  - **Reverberation times exceed 1.5s at speech frequencies of 500 Hz to 2 kHz**
  - **Background noise levels exceed 75dBA**
  - **Probable loudspeaker to listener distances exceed 10m**

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Clarity and Intelligibility of Speech

Audio quality comparison :

- **Soundtrack 1:**
  - **'Ladies and gentlemen, your attention please. This is to draw a line, it may reduce your mobility.'**

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Clarity and Intelligibility of Speech

Audio quality comparison :

- **Soundtrack 1:**
  - **'Ladies and gentlemen, your attention please. This is to draw a line, it may reduce your mobility.'**
- **Soundtrack 2:**
  - **'Ladies and gentlemen, your attention please. This is a false alarm, you may resume your normal duties.'**

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Interface to Fire Alarm System

When Fire Alarm is activated,

- **The Event Recording Device for the EVC Systems start and remain recording until manual reset.**
- **The BGM stop and remain mute until manual re-start.**
- **Alarm sounding devices to be muted with a visual indication when the loudspeakers are in use, but only after the Fire Alarm have operated for not less than 15 seconds.**

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Operations and Maintenance

- The EVC Systems are meant to be operated by trained personnel such as Fire Safety Operators and Fire Wardens
- Maintenance agreement to be established with competent contractors
- Regular testing and inspection
- Check before and after any alteration and addition works
- Log
  - As-built drawing
  - Up-date of systems status

Thank You

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Enabling Enterprise

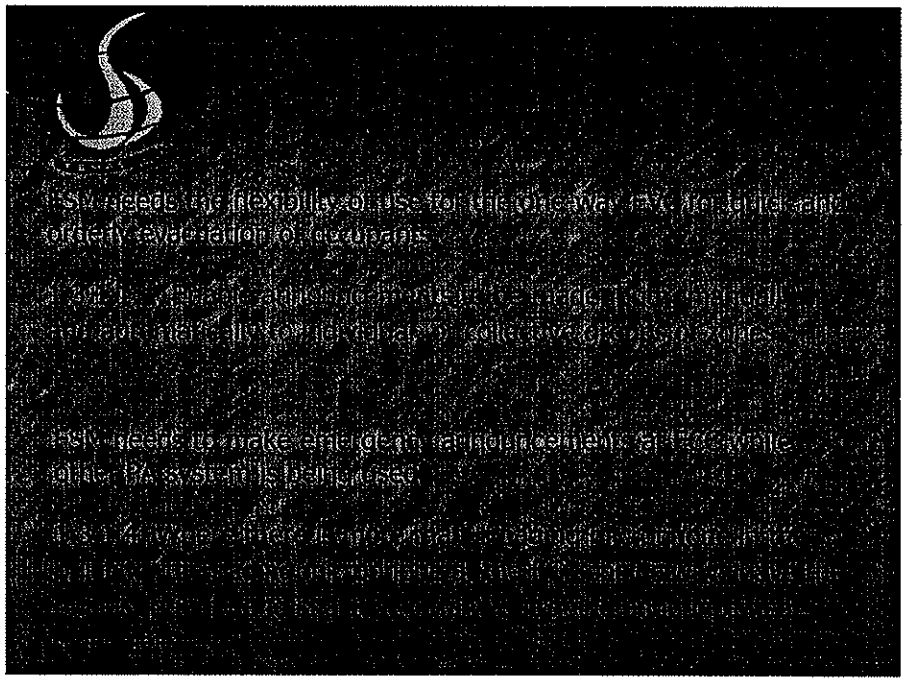
Practical Applications and Implementation Benefit of SS 546 : 2009 - A Fire Safety Manager's Perspective

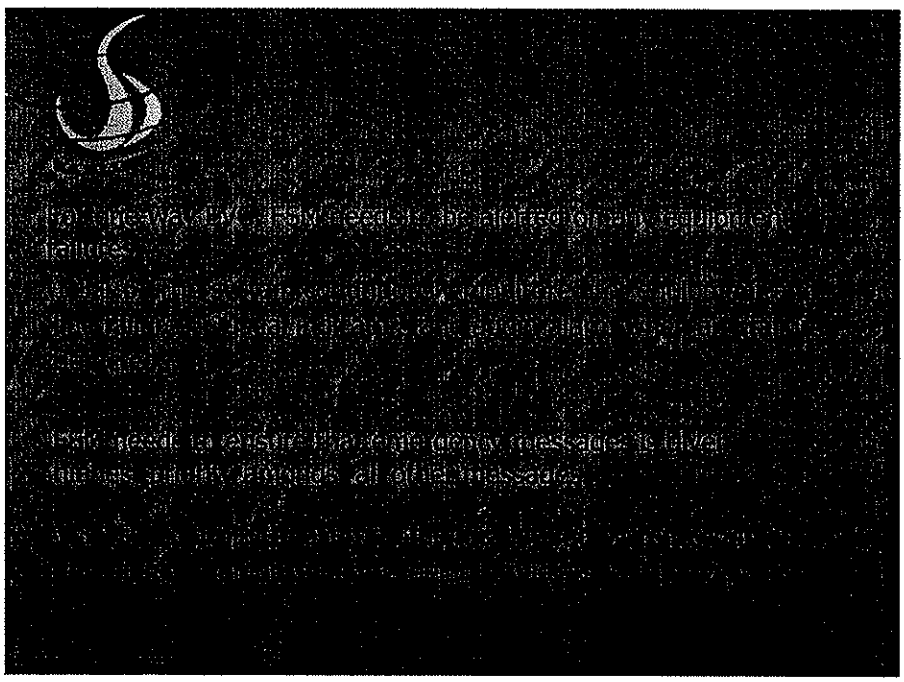
[illegible]

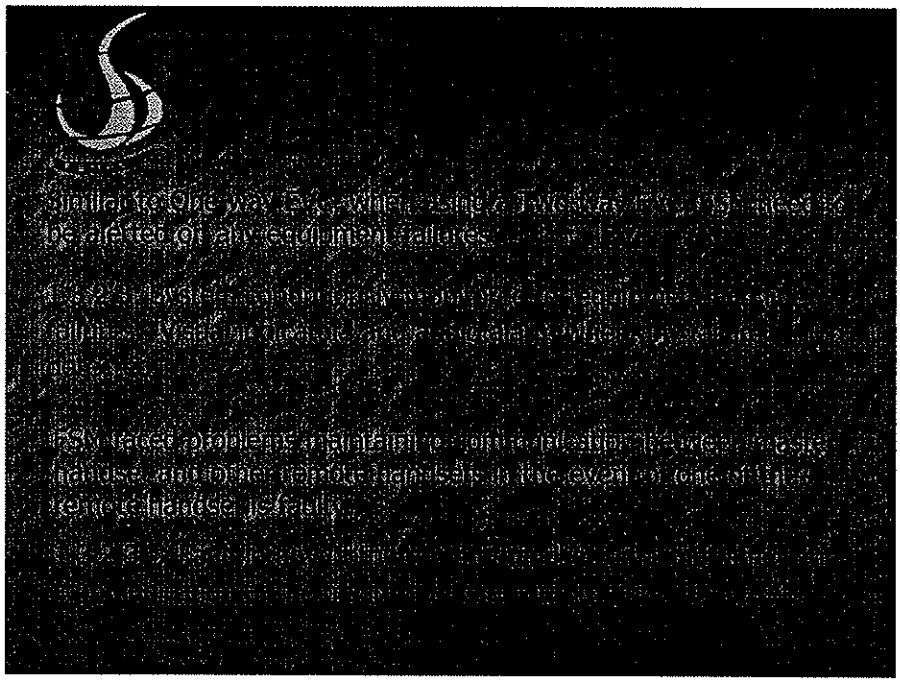
[illegible]

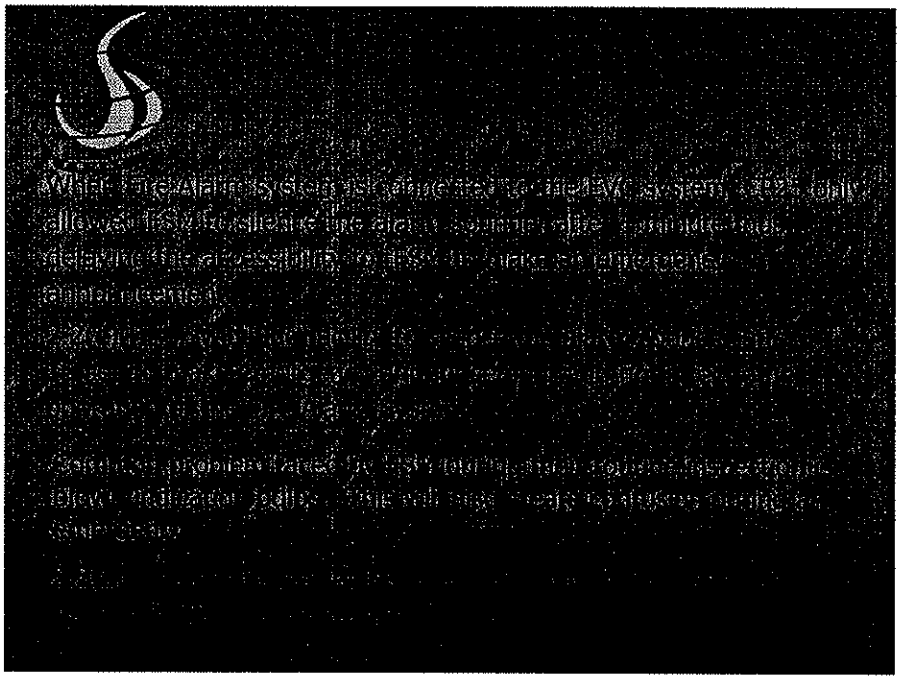
Advantages of One-way EVC

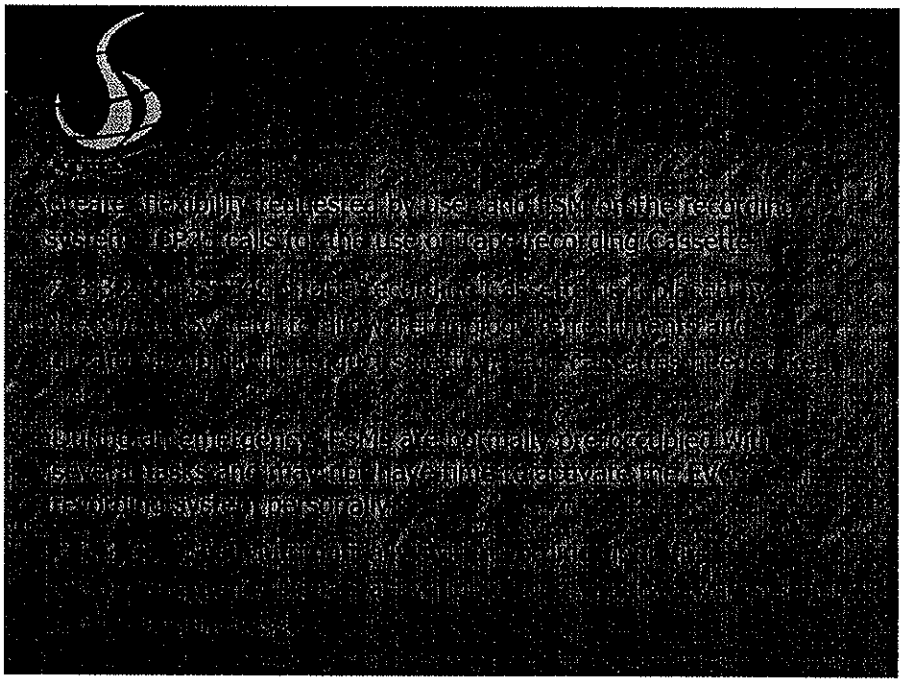
- [illegible]
- [illegible]
- [illegible]
- [illegible]

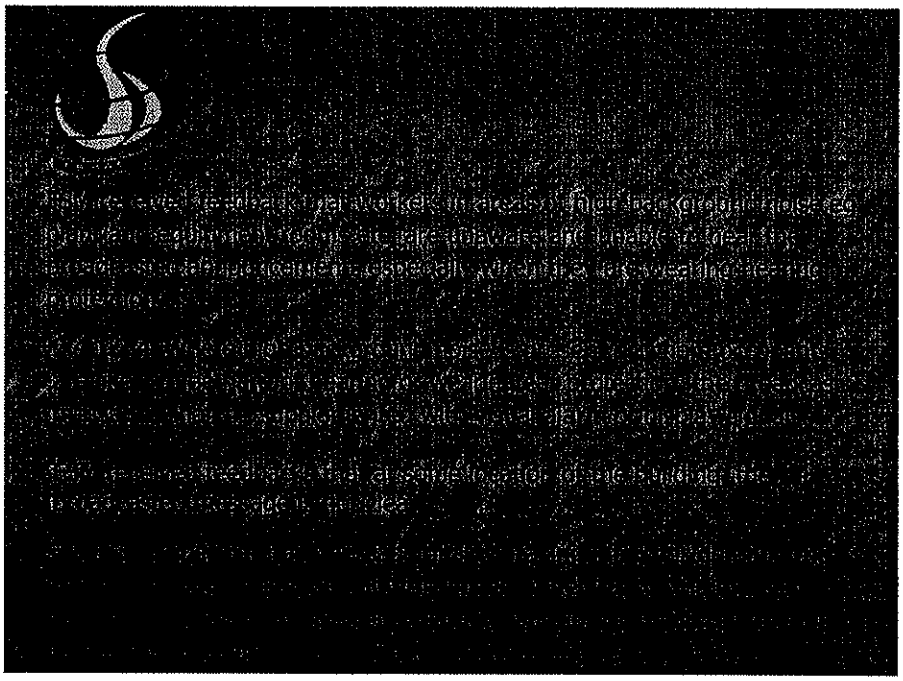


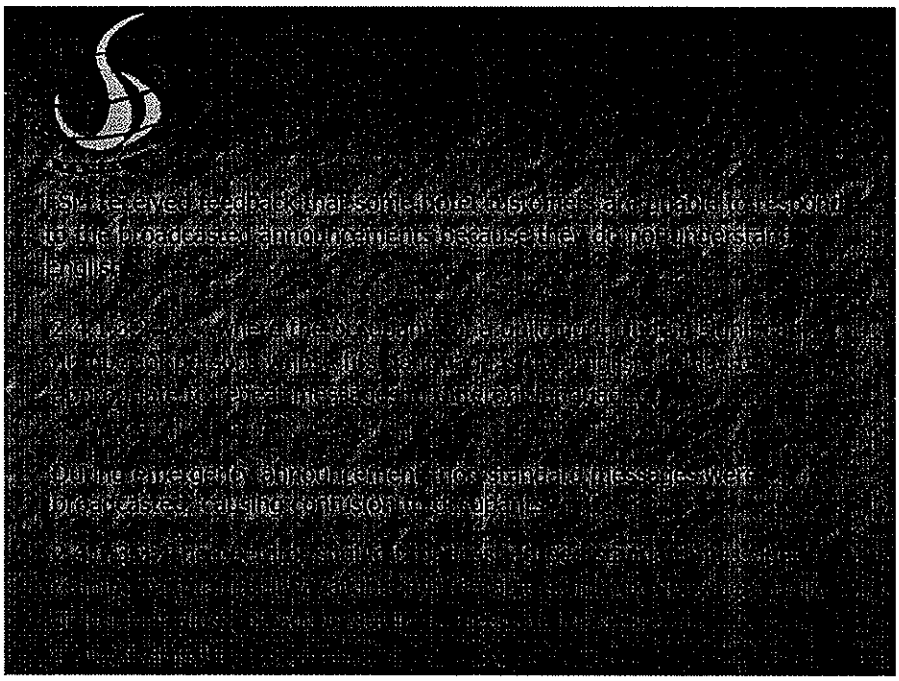


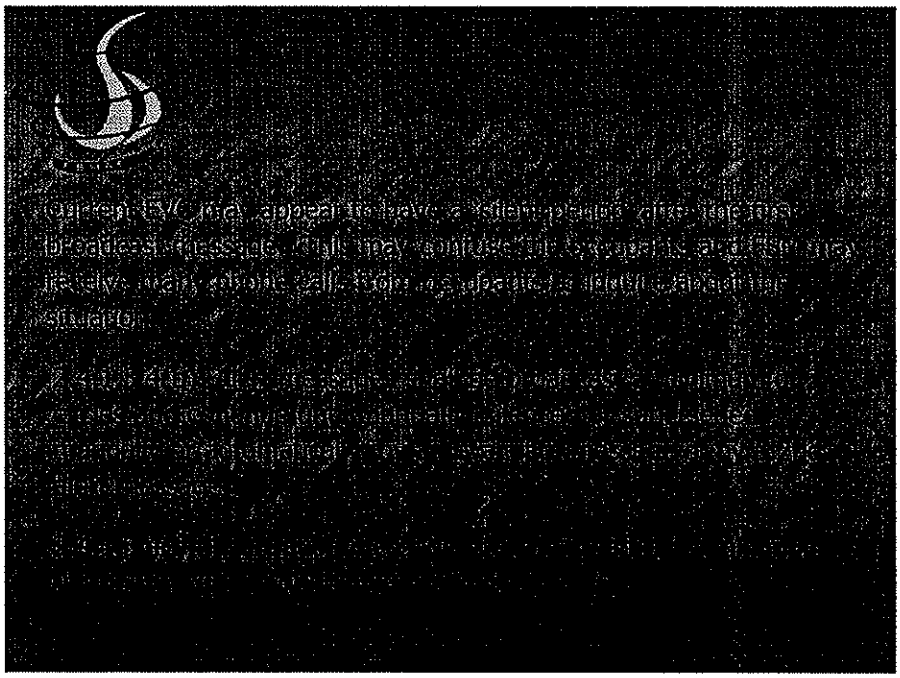


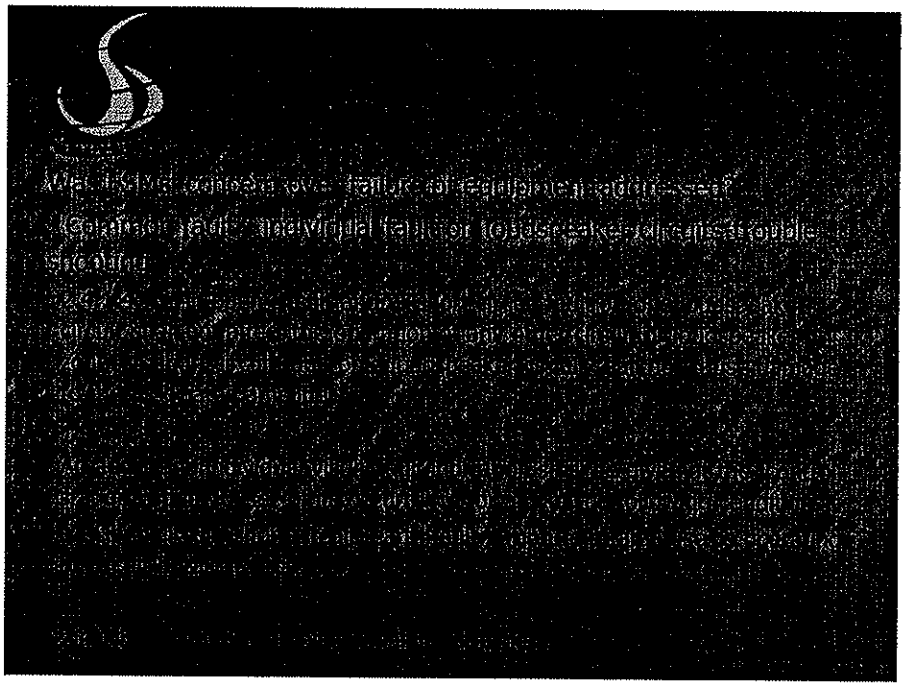


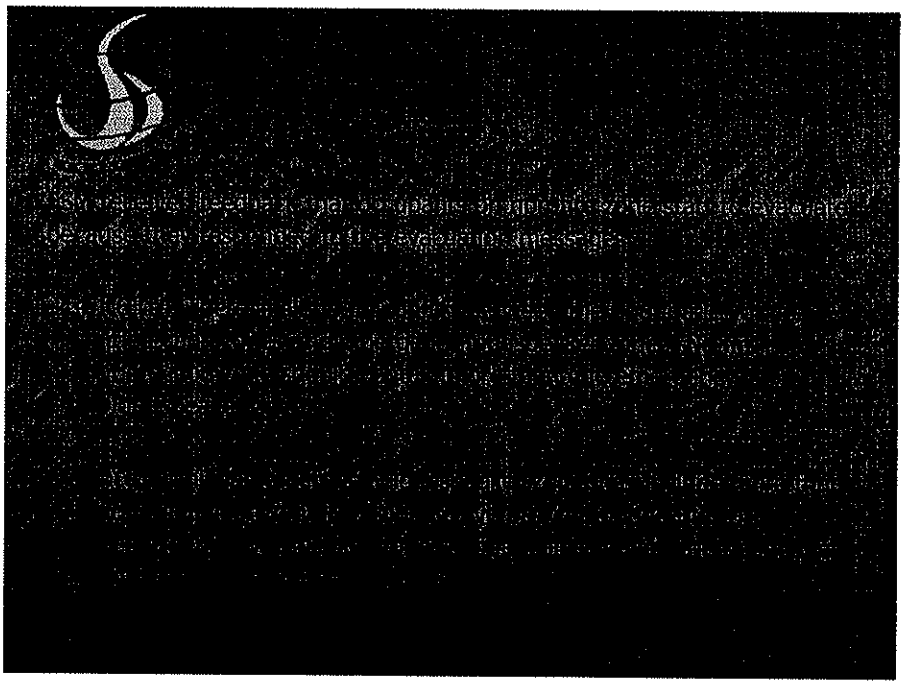


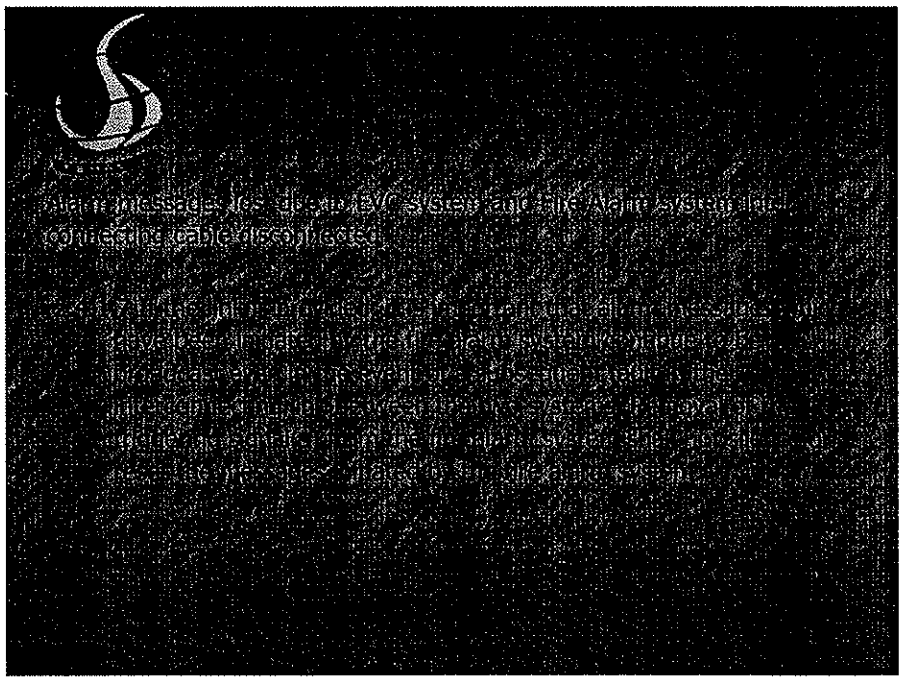


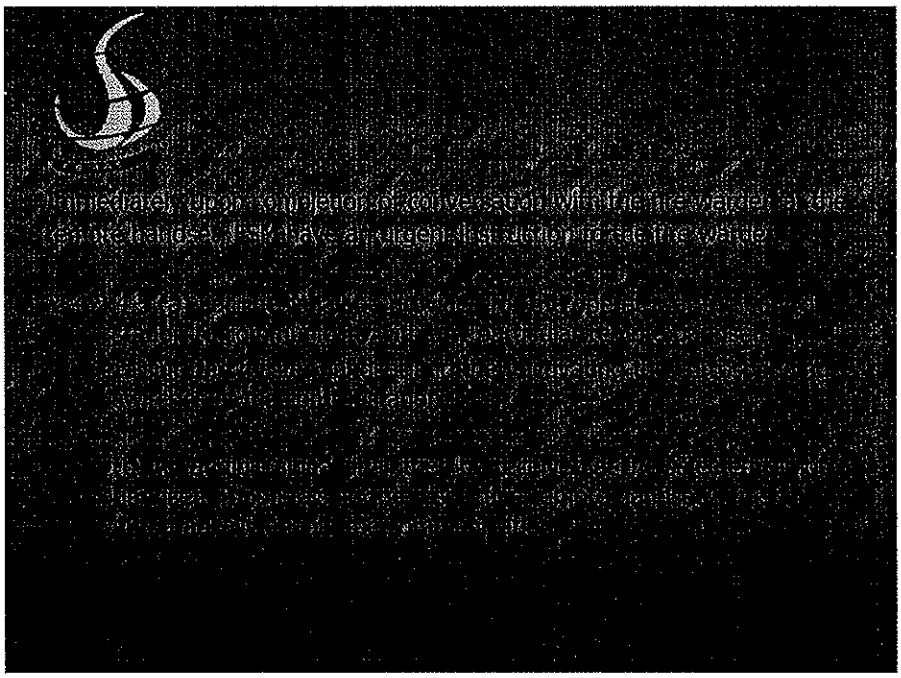


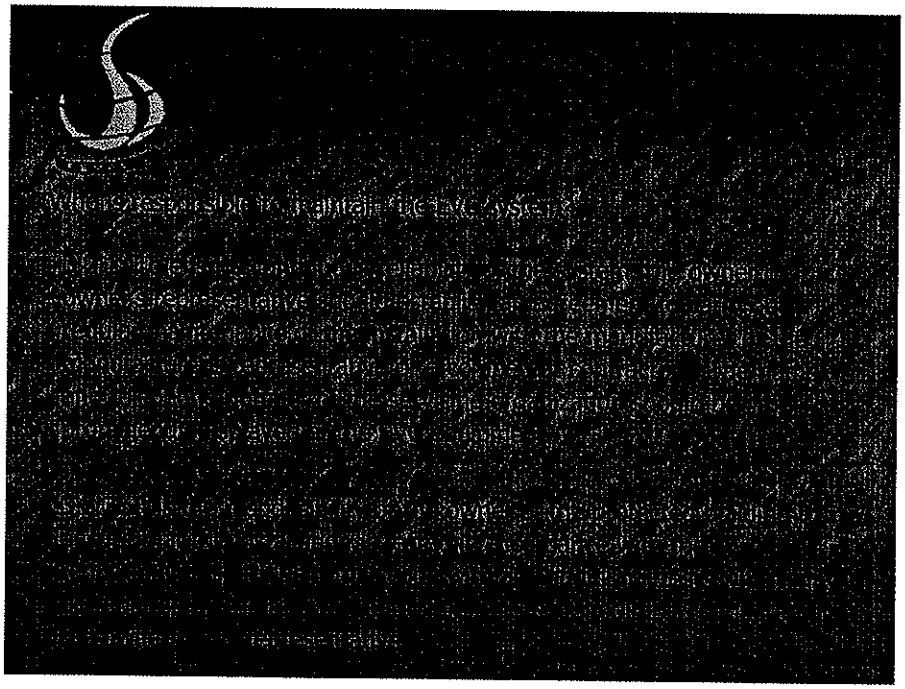


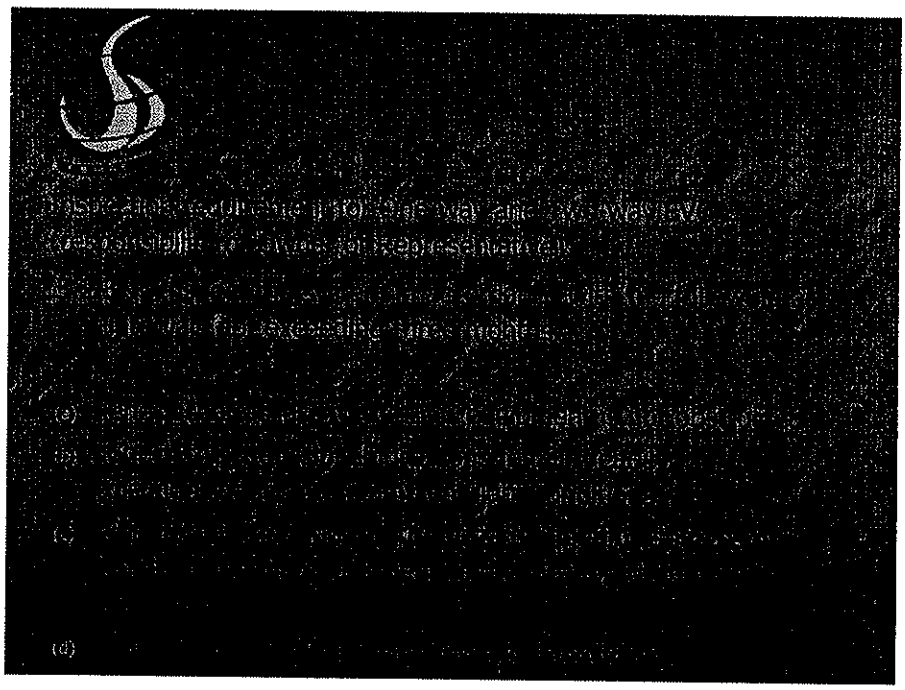


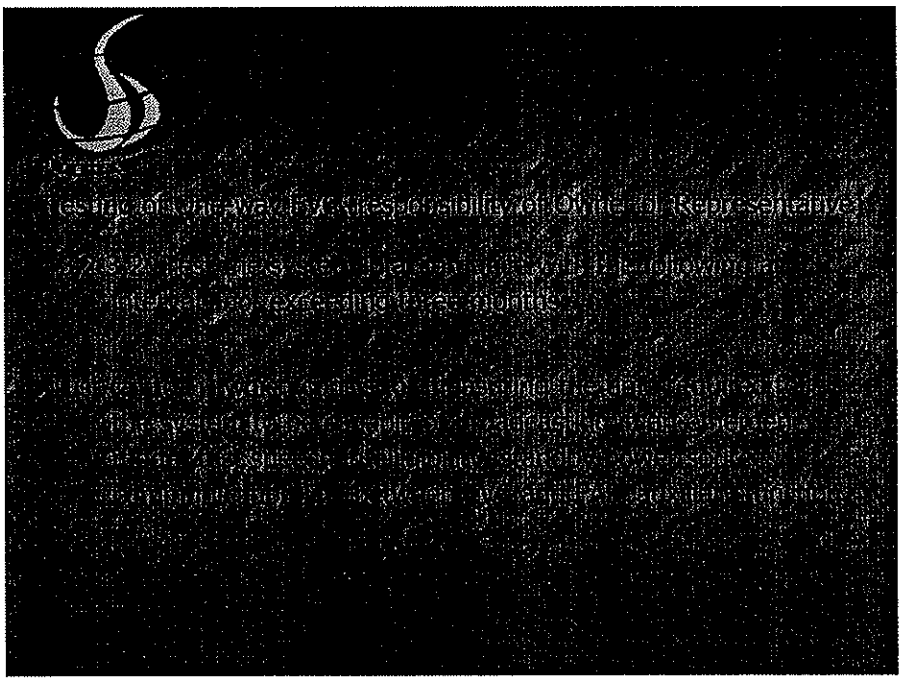


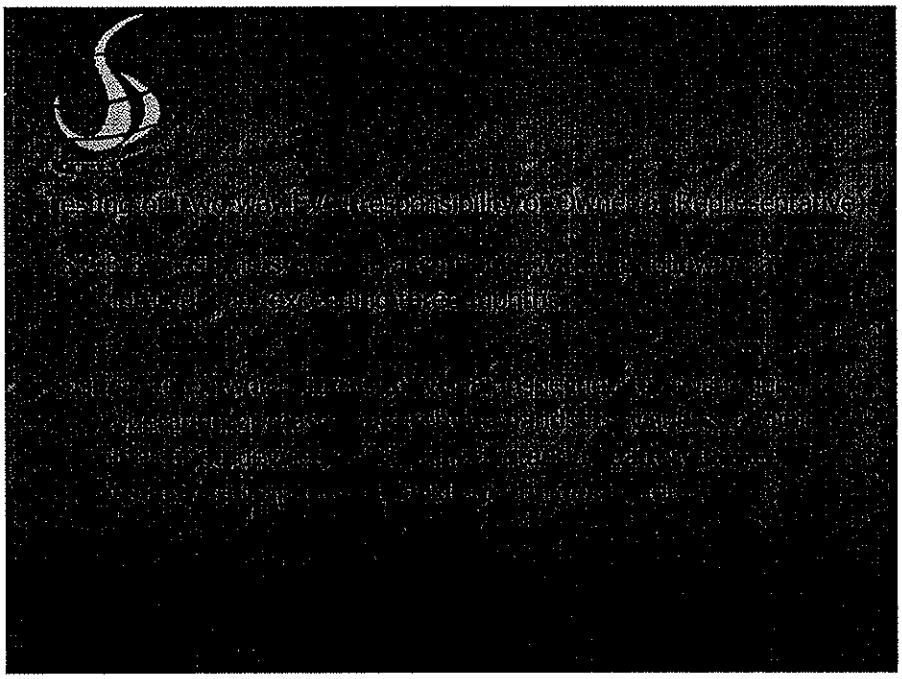


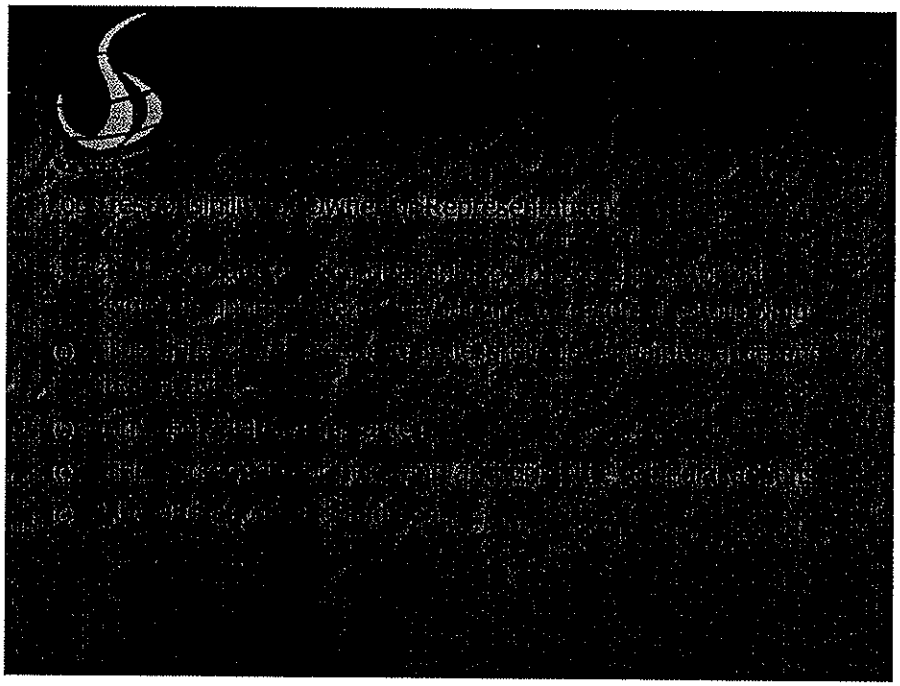


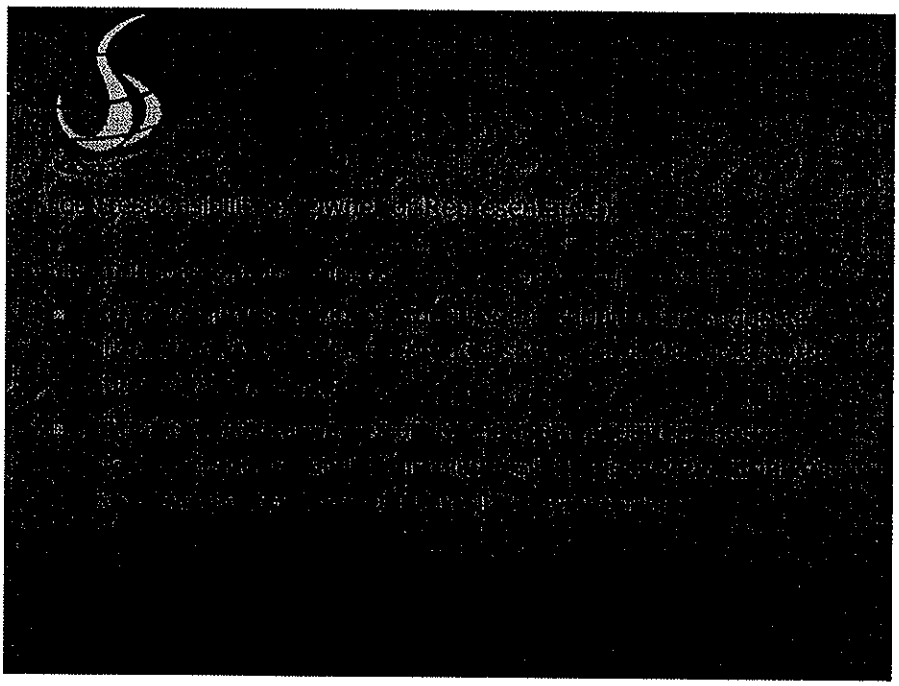


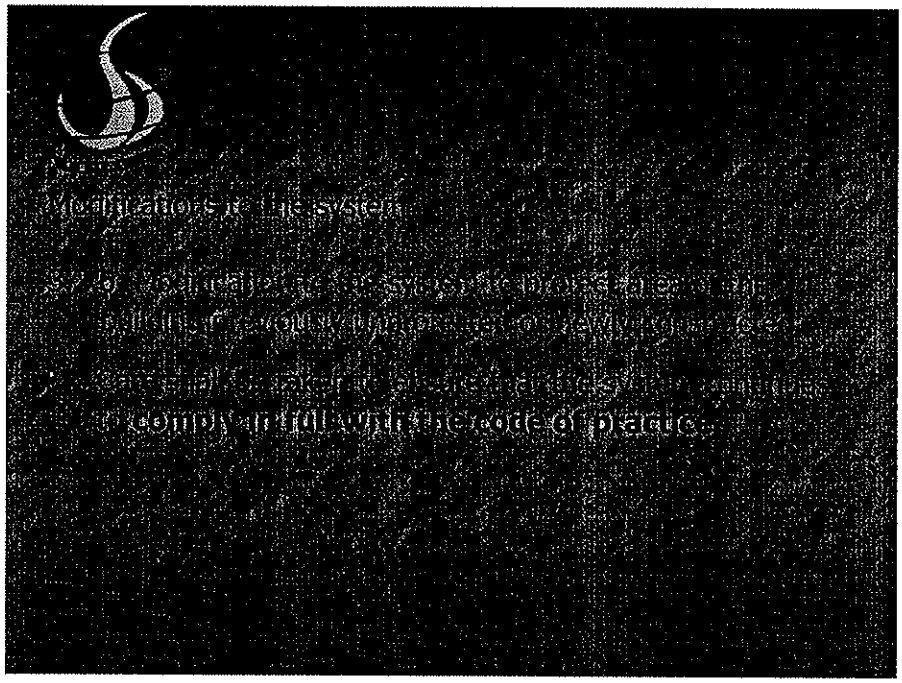




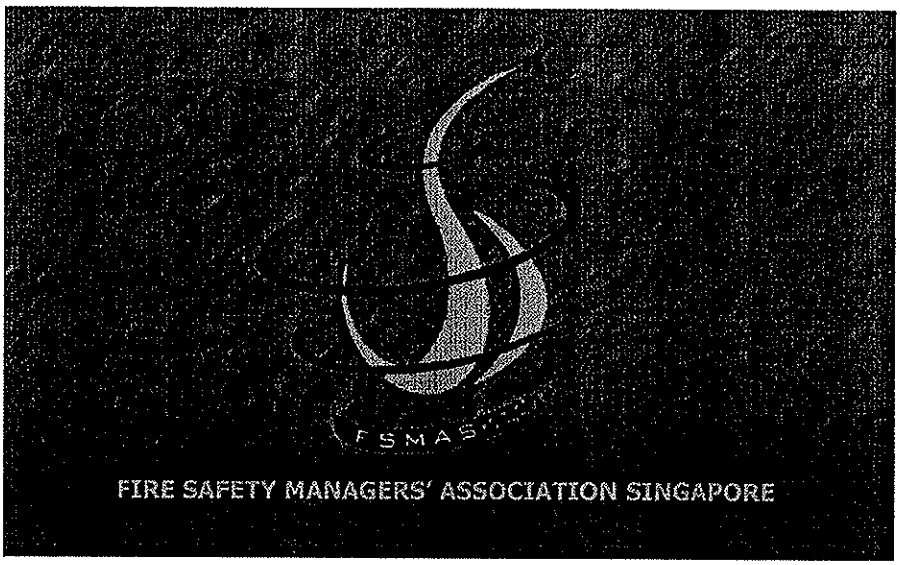







Modifications to the system
to comply with the code of practice

THANK YOU


FSMAS
FIRE SAFETY MANAGERS' ASSOCIATION SINGAPORE

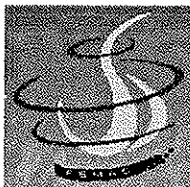
Practical Applications and Implementation Benefit of SS 546 : 2009 - A Fire Safety Manager's Perspective

BENEDICT KOH - Member, Technical Committee for Emergency Alarm & Communication systems

- President, Fire Safety Managers' Association Singapore

Advantages of One-way EVC

- Bell sounding are usually ignored by occupants
- Voice messages can differentiate between an alert or an evacuation event
- Ability to evacuate occupants in a orderly manner
- The code allows alarm bells to be silenced after 15 seconds and replace with voice announcements, if the Fire Alarm System is connected to the One-way EVC System. This reduces disturbance caused by the mandatory 3 minute bell sounding in buildings that are not provided with a One-way EVC System.



FSM needs the flexibility of use for the one-way EVC for quick and orderly evacuation of occupants

1.3.1.1: ..Enable announcements to be made, both manually and automatically to individual, or collective groups of zones,...

FSM needs to make emergency announcements at FCC while other PA system is being used.

1.3.1.4: Where there is more than 1 paging microphone in the building, the paging microphone at the FCC shall always have the highest priority and shall cut-off any out going announcements when selected.

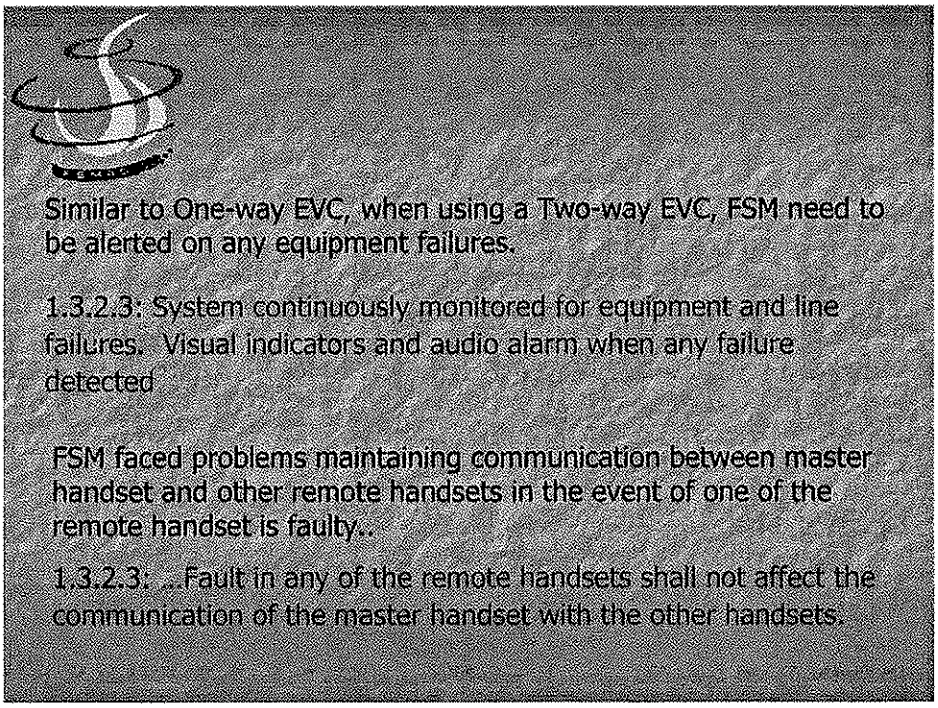


For one-way EVC, FSM needs to be alerted on any equipment failures.

1.3.1.6: The system continuously monitored for equipment and line failures. Visual indicators and audio alarm when any failure detected...

FSM needs to ensure that emergency messages is given highest priority amongst all other messages.

1.3.1.7: ..Facility to override the local sound system when any emergency announcement is being broadcast to the respective area.

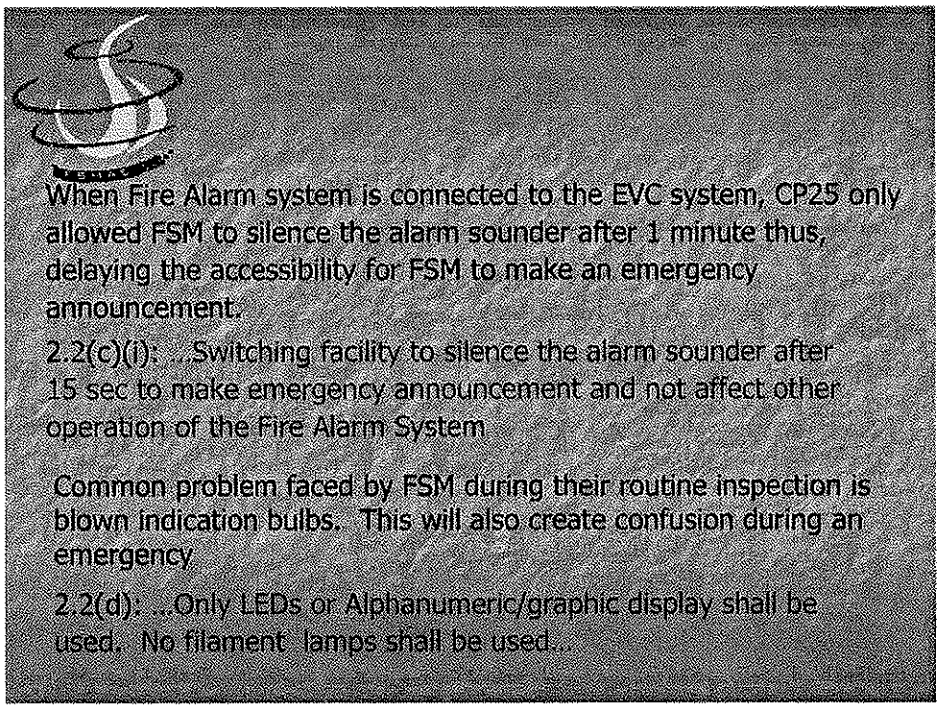


Similar to One-way EVC, when using a Two-way EVC, FSM need to be alerted on any equipment failures.

1.3.2.3: System continuously monitored for equipment and line failures. Visual indicators and audio alarm when any failure detected

FSM faced problems maintaining communication between master handset and other remote handsets in the event of one of the remote handset is faulty..

1.3.2.3: ..Fault in any of the remote handsets shall not affect the communication of the master handset with the other handsets.

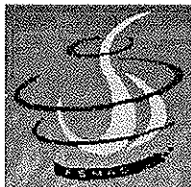


When Fire Alarm system is connected to the EVC system, CP25 only allowed FSM to silence the alarm sounder after 1 minute thus, delaying the accessibility for FSM to make an emergency announcement.

2.2(c)(i): ..Switching facility to silence the alarm sounder after 15 sec to make emergency announcement and not affect other operation of the Fire Alarm System

Common problem faced by FSM during their routine inspection is blown indication bulbs. This will also create confusion during an emergency

2.2(d): ..Only LEDs or Alphanumeric/graphic display shall be used. No filament lamps shall be used..



Greater flexibility requested by user and FSM on the recording system. CP25 calls for the use of Tape recording Cassette.

2.3.3.2: In SS 546, 'Tape recording Cassette' is replaced by 'Recording System' to allow Technology refreshments and greater flexibility in product selection. –no cassettes needed kept ..etc.

During an emergency, FSMs are normally pre-occupied with several tasks and may not have time to activate the EVC recording system personally.

2.3.3.3: ..Shall automatically start recording upon fire alarm/emergency signals activation of one-way/two-way systems until manually reset.



FSM received feedback that workers in areas of high background noise eg. plant and equipment rooms etc, are unaware and unable to hear the broadcasted announcements especially when they are wearing hearing protection.

2.4.1.2.4: Where high background noise is present or where occupants are likely to be hard of hearing or wearing ear protection, the broadcast messages shall be supplemented with visual alarm or display signals..

FSM received feedbacks that at some location of the building, the broadcasted message is not clear.

2.4.1.3.1: Specified the 'message quality', taking into consideration the frequency range, repetition and the speed of delivery of the message taking into account the acoustic characteristics of the most reverberant part of the building.

FSM received feedback that some hotel customers are unable to respond to the broadcasted announcements because they do not understand English

2.4.1.3.2: .....where the occupants of a building include a significant number of persons whose first language is not English, it may be appropriate to repeat messages in different language(s)....

During emergency announcement, non standard messages were broadcasted, causing confusion to occupants

2.4.1.3.3: The operator should broadcast agreed standard messages, reading from a readily available and durable script, except where a fire officer or trained person in authority needs to make special announcements.

Current EVC may appear to have a 'silent period' after the first broadcast message. This may confuse the occupants and FSM may receive many phone calls from occupants to inquire about the situation.

2.4.1.3.4(b): Alert messages shall be broadcast a minimum of 2 cycles and continue until manually silenced or superseded, manually or automatically, by an evacuate message or by a 2nd alert message.

2.4.1.3.4(c): Evacuation message shall be broadcast a minimum of 2 cycles and continue until manually silenced.

Was FSMs' concern over failure of equipment addressed?

- Common fault / individual fault on loudspeaker circuits-trouble shooting

2.4.1.4: ... An open circuit and/or short circuit fault on one loudspeaker circuit shall not affect the operation of any other circuit or loudspeaker zone. A short circuit fault on a loudspeaker circuit shall not cause damage to the associated amplifier.

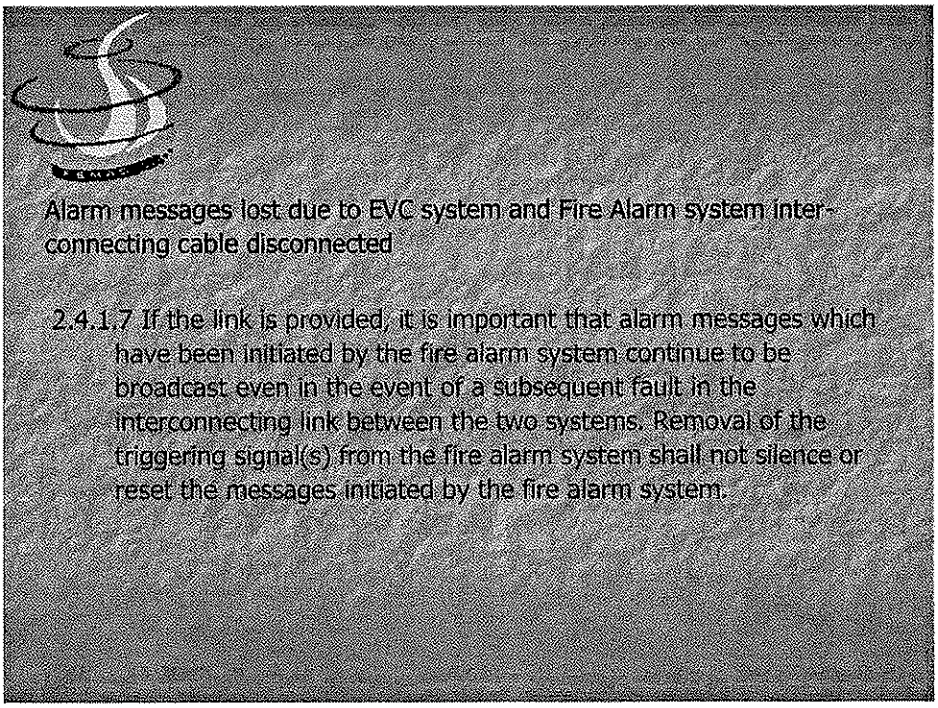
An audio and individual visual fault indication shall be given at the control station within 100sec of its occurrence for any of the following conditions: - ... Open circuit, short circuit, earth fault... rupture of any fuses... operating of circuit breakers ... etc

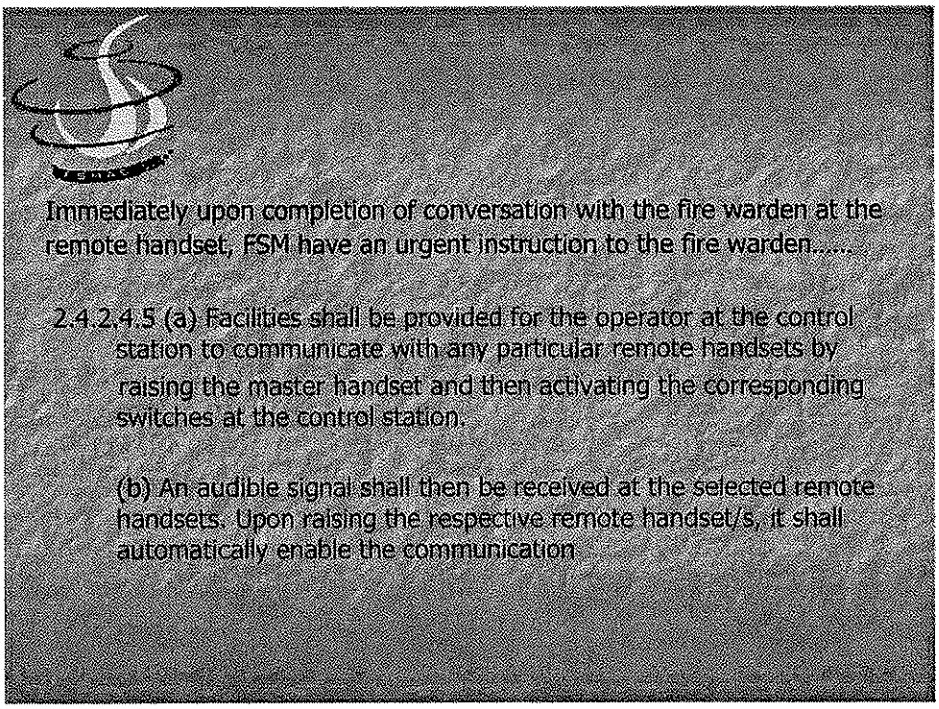
2.4.1.5: ... Standby amplifier shall be provided ...

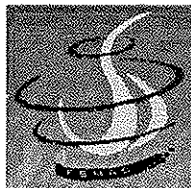
FSM received feedback that occupants on non-fire zone start to evacuate because they responded to the evacuation messages.

2.4.1.6 (b): There shall be no conflict between the boundaries of fire detection zones and emergency loudspeaker zones. No fire detection zone should contain more than one emergency loudspeaker zone.

(e): While an emergency loudspeaker zone may include more than one detection zone (but not vice versa), the boundaries of emergency loudspeaker zones should coincide with the boundaries of the relevant detection zones(s).


Alarm messages lost due to EVC system and Fire Alarm system inter-connecting cable disconnected
2.4.1.7 If the link is provided, it is important that alarm messages which have been initiated by the fire alarm system continue to be broadcast even in the event of a subsequent fault in the interconnecting link between the two systems. Removal of the triggering signal(s) from the fire alarm system shall not silence or reset the messages initiated by the fire alarm system.

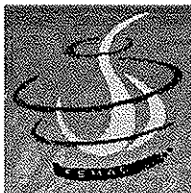

Immediately upon completion of conversation with the fire warden at the remote handset, FSM have an urgent instruction to the fire warden.....
2.4.2.4.5 (a) Facilities shall be provided for the operator at the control station to communicate with any particular remote handsets by raising the master handset and then activating the corresponding switches at the control station.
(b) An audible signal shall then be received at the selected remote handsets. Upon raising the respective remote handset/s, it shall automatically enable the communication



Who is responsible to maintain the EVC system?

3.2.1: To ensure continuous reliability of the system, the owner or owner's representative should establish an agreement to carry out regular maintenance of the installation with the manufacturer or the manufacturer's representative or a competent contractor... The name and telephone number of the servicing organization should be prominently displayed at the EVC equipment.

3.2.2: It is the responsibility of the owner of the protected building to ensure that the installation is tested in accordance with the requirements specified in this code with any additional tests which may be required by the relevant authority. The test should be conducted by the owner or his representative ...



Inspection requirement for One-way and Two-way EVC (responsibility of Owner or Representative):

3.2.3.1: Inspect the system in accordance with the following at intervals not exceeding three months:

- Check that access to the EVC equipment is not obstructed.
- Check the the visible indications remain readily distinguishable in the ambient light conditions.
- Check that there are no fire hazards (ignition sources or combustible materials) near to the location of the EVC equipment.
- Check that operating instructions are available.

Testing of One-way EVC (responsibility of Owner or Representative):

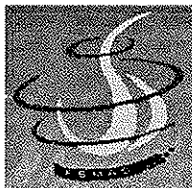
3.2.3.2: Test the system in accordance with the following at intervals not exceeding three months:

List (a) to (j) which consist of measuring the time required for the system to be capable of broadcasting in an emergency mode, test speech intelligibility, standby power source, communication link between EVC and FAS, auxiliary function ..etc.

Testing of Two-way EVC (responsibility of Owner or Representative):

3.2.3.3: Test the system in accordance with the following at intervals not exceeding three months:

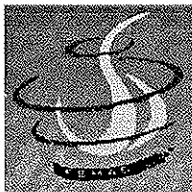
List (a) to (j) which consist of visual inspection for obstruction, operating of master and remote handsets, visual & audible indicating devices at FCC, check standby battery power source, fault indicators, auxiliary functions ..etc.



Log (responsibility of Owner or Representative):

3.2.4: The means of recording shall be provided in a format which is appropriate to the building to record the following:

- The dates and times of routine/preventive maintenance and test activities.
- Any remedial actions taken.
- The personnel who take and authorize the remedial actions.
- Any alterations and additions.



Log (responsibility of Owner or Representative):

The purpose of such a log is:

- To allow investigation of the incident should it be suggested that the system failed to broadcast in a particular area at the time of an incident.
- To allow maintenance staff to monitor the pattern of the faults arising, so aiding the diagnosis of the system problems and the management of preventive maintenance.

Modifications to the system

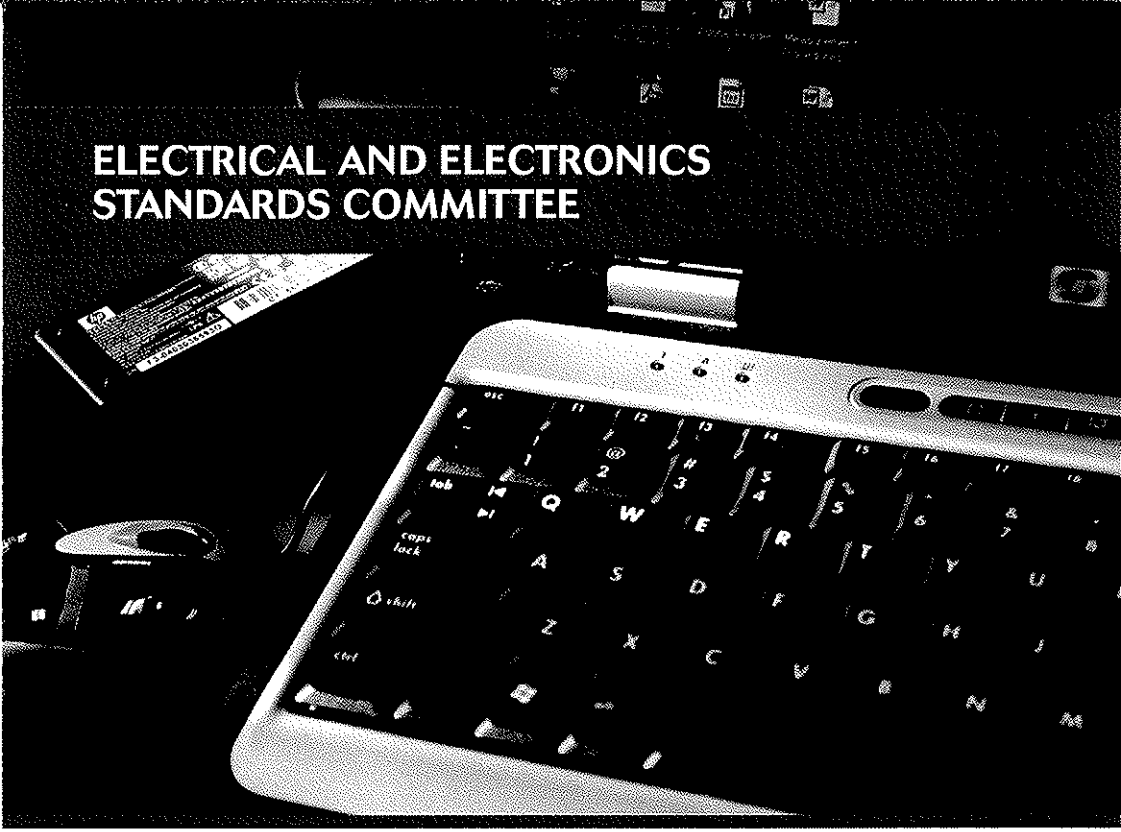
3.2.6: Modification to the system to protect area of the building previously unprotected or newly constructed.

Care shall be taken to ensure that the system continues to **comply in full with the code of practice.**

THANK YOU

FIRE SAFETY MANAGERS' ASSOCIATION SINGAPORE

ELECTRICAL AND ELECTRONICS STANDARDS COMMITTEE



OBJECTIVES

The Electrical and Electronic Standards Committee (EESC) develops and maintains market relevant standards to meet the needs of the electrical and electronic industry.

SCOPE

The EESC's work covers the standardisation of equipment, systems and installations for the distribution and use of electricity and electro-technical products.

SPRING singapore

Enabling Enterprise

COMMITTEE MEMBERS

Chairman: **Mr Renny Yeo,** *representing* Standards Council
Deputy Chairman: **Mr Peter Leong,** *representing* Standards Council

Other representatives are from:

INDUSTRY

- Association of Consulting Engineers Singapore
- Institution of Engineers Singapore
- Singapore Business Federation
- Singapore Electrical Contractors and Licensed Electrical Workers Association
- Singapore Electrical Trades Association
- Singapore International Chamber of Commerce
- Singapore Manufacturers' Federation
- SP PowerGrid
- TÜV SÜD PSB Pte Ltd

GOVERNMENT

- Agency for Science, Technology and Research
- Energy Market Authority
- Housing & Development Board
- Land Transport Authority
- SPRING Singapore

ACADEMIA

- Nanyang Technological University
- National University of Singapore

The term of service of the Standards Council and its committees is three years, from 1 April 2007 to 31 March 2010.

WHAT WE DO

The EESC drives and develops market relevant standards to meet the competitive needs of the electrical and electronics industries.

This includes efforts to align Singapore Standards under its purview to the relevant international standards. It also promotes the use of these standards amongst industry to achieve higher business growth and gain better market access. New areas such as renewable energy and energy efficiency are increasing in prominence in EESC's workplans.

Some standards of EESC support the Consumer Protection (Safety Requirements) Registration Scheme to ensure safety for 45 categories of electrical and electronic products that are registered as controlled goods, as well as other regulatory agencies such as the Energy Market Authority, and Fire Safety and Shelter Department.

At the international level, Technical Committees (TCs) appointed by the EESC also monitor and participate in the work of the relevant International Electrotechnical Commission (IEC) TCs and Sub Committees (SCs) in areas which will help contribute towards Singapore's competitiveness and export overseas.

The EESC also helps the market access of industry by reviewing and monitoring relevant IEC standards used in the IEC Conformity Assessment Schemes to assess their suitability for use in Singapore. These schemes help local enterprises so that products tested in Singapore will be recognised overseas and hence eliminate duplication of tests of compliance to IEC standards. These schemes are:

- IECEE CB Scheme (IEC System for Conformity Testing and Certification of Electrotechnical Equipment and Components)
- IECEx Scheme (IECEx Certified Equipment Programme and IECEx Certified Service Facilities Programme), and
- IECQ Hazardous Substances Process Management Programme (HSPM)

A SNAPSHOT OF RECENT ACHIEVEMENTS

- Number of Singapore Standards/Technical References : **72**
- Number of Standards Partners : **182**

SS 538 : 2008 Standards for Maintenance of Electrical Equipment of Electrical Installations
SS 538 provides clear guidelines on establishing a system of routine maintenance for electrical systems, installations, plants and installed electrical equipment in buildings, for voltages of up to 22kV. It provides a guide for keeping both indoor and outdoor electrical equipment (and their associated apparatus) in good working order.

SS 535 : 2007 Standards to Ensure Uninterrupted Power Supply
SS 535 covers the design, construction, installation, operation, testing, inspection and maintenance of standby mains failure generating sets for buildings. It establishes uniformity in electrical engineering practices among building owners, consulting engineers, contractors, equipment suppliers, fire safety managers and regulators.

AREAS WE ARE INVOLVED IN

- Distribution of electrical energy, power transformers, switchgear assemblies and controlgears
- Cable management systems, electric cables and electrical accessories
- Lighting applications, safety of luminaries and components
- Safety of electrical and electronic products
- Electro-magnetic compatibility and radio interference
- Building electrical installations and maintenance of electrical equipment
- Emergency communication and alarm systems of buildings
- Lifts, escalators and passenger conveyors
- Lightning protection of buildings
- Electrical equipment and systems for railways
- Nanotechnology standardisation for electrical and electronic products and systems

MAJOR SINGAPORE STANDARDS/TECHNICAL REFERENCES

SS 538 : 2008	Maintenance of Electrical Equipment of Electrical Installations
SS146 Part 2-8 : 2007	Household and Similar Electrical Appliances - Safety: Particular Requirements for Storage WaterHeaters
SS 535 : 2007	Installation, Operation, Maintenance, Performance and Construction Requirements of Mains Failure Standby Generating Systems
SS 263 : 2005	Luminaires, Part 1 General Requirements and Tests
SS 516 : 2005	Application, Operation and Maintenance of Dry-type Transformers
CP 10 : 2005	Installation and Servicing of Electrical Fire Alarm Systems
CP 19 : 2000	Installation and Maintenance of Emergency Lighting and Power Supply Systems in Buildings
CP 2 : 2000	Installation, Operation and Maintenance of Electric Passenger and Goods Lift
CP 5 : 1998	Electrical Installations

PLAY A PART – IT CAN BENEFIT YOU AND YOUR INDUSTRY

Singapore Standards are established and promoted by volunteers, also known as standards partners, who share a common belief in the value of standardisation and the spirit of collaboration in sharing knowledge and achieving consensus for the common good.

Participating in the EESC allows you to stay in the forefront of the latest developments in regional and international electrical and electronics standardisation. It also provides opportunities for you to network with experts and industry players. If you are interested to play a part in shaping the electrical and electronics standardisation landscape, we welcome you to join us!

SPRING has more details on how standardisation can benefit you and your business.

Please call tel: (65) 6279 1818, fax: (65) 6278 6990,
or email: stn@spring.gov.sg or visit our website: www.standards.org.sg.